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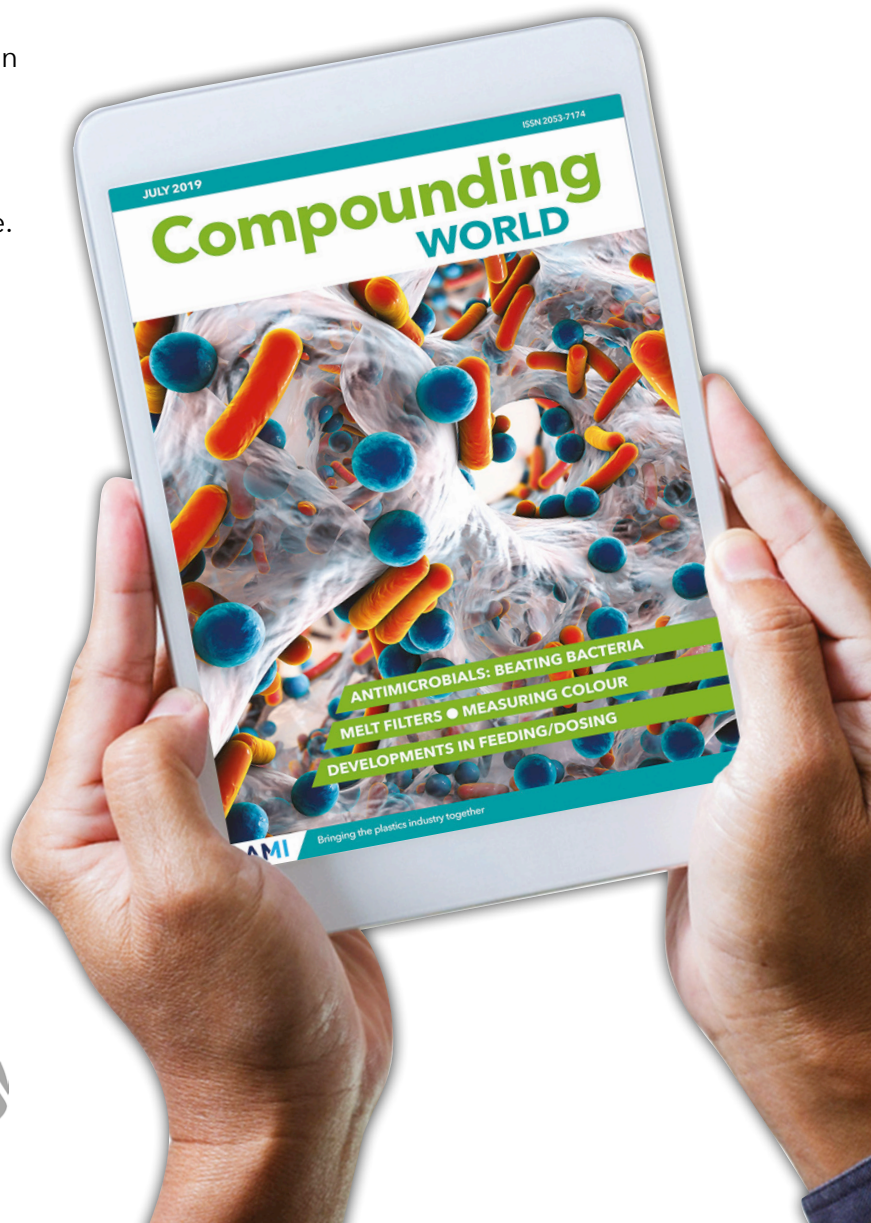
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Compounding WORLD

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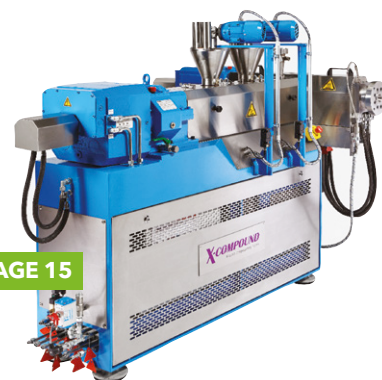
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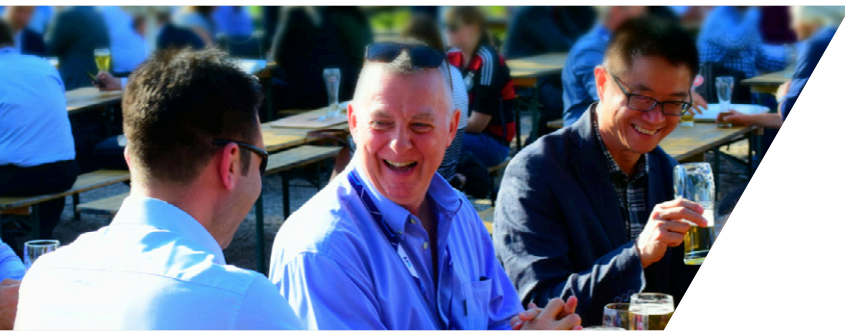
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AMI announces new dates for Essen plastics expos

AMI has announced that its four focused plastics industry exhibitions, which were scheduled to take place at Messe Essen in Germany on 3-4 June, have been postponed to 7-8 October 2020. The decision to delay the Compounding World Expo, Plastics Recycling World Expo, Plastics Extrusion World Expo and Polymer Testing World Expo is due to the uncertainties created by the global Coronavirus (COVID-19) pandemic.

"We have been reviewing the fast-changing situation daily, and we have been consulting with exhibitors, Messe Essen, local government and

health authorities," said Rita Andrews, Head of Exhibitions at AMI, which publishes *Compounding World* magazine. "Our primary concerns are for the health and safety of all attendees at our events, and delivering the very best audience for our exhibitors."

The shows will remain in the same two halls at Messe Essen, retaining the same floorplans with five free-to-attend conference theatres. The aim is to retain the existing conference programmes, augmented with additional speakers over the coming months.

AMI announced the decision to postpone the expos on Monday 23

March. Andy Beevers, AMI Events Director said: "We felt it was important to make and announce this decision now, in order to end the current uncertainty and to allow exhibitors, speakers and attendees to plan effectively for the new dates".

Exhibitor numbers for the 2020 shows are up by over 80% compared to AMI's launch event in 2018. More than 1,500 people have already registered to attend the 2020 expos and those bookings will transfer automatically to the new dates.

> <https://www.ami.international/exhibitions>

Coronavirus pandemic update



We are living in unbelievably challenging times. Coronavirus restrictions mean much of global manufacturing is near shut-down, leaving many plastics companies facing intense business pressures. The outlook is uncertain and the potential impact on all of us is on an unprecedented scale in financial, personal and lifestyle terms. We can only look forward, take what opportunities arise in today's difficult conditions, and try to position ourselves as best we can for when restrictions ease and our lives begin to return to normality. At *Compounding World*, that means we will continue to do our best to bring you the latest business news and technical information so you are prepared for whatever the future brings. In the meantime, please follow best practice, keep safe and stay healthy.

Chris Smith, Editor

Trinseo launches Pulse ECO

Trinseo has launched Pulse ECO, a portfolio of PC/ABS blends for automotive applications with 30-50% recycled content.

Based on its Pulse GX technology, the Pulse ECO materials combine post-industrial recycled PC from European sources with Trinseo's virgin Magnum brand ABS. They are said to provide good flow, low temperature ductility, reduced CO₂ footprint and a low density (the company claims up to 3% more parts per tonne than competitor materials).

The company says the first grades – Pulse GX50 ECO and GX70 ECO – will be made available in Europe during 1H 2020.

> www.trinseo.com

Mitsubishi acquires Minger

Mitsubishi Chemical has acquired the Swiss engineering plastics recycler Minger Group, parent of Minger Kunststofftechnik and Minger Plastics.

Minger is based in Appenzell, employs 26 staff and generates annual sales

of around €9.3m. It claims to have proprietary recycling technologies for engineering plastics such as PA, PEEK and PVDF as well as a well established European material collection network.

Mitsubishi said the move is part of its effort to

promote the Circular Economy and realise its 'Kaiteki' vision. It said it "will allow [it] to establish an integrated business model for engineering plastics, from manufacturing to sales, machining, collection and reuse".

> www.m-chemical.co.jp

Italy's Promixon bankrupt

Italian mixing machinery Promixon was declared bankrupt last month by the court in Busto Arsizio. Production at its plant at Magnano in the Lombardy region has been halted since the end of last year.

The company applied for bankruptcy after losing the latest round in a lengthy legal dispute brought by competitor Plas Mec, which is based at nearby Lonate Pozzolo. According to Paola Giudici, the court-appointed insolvency administrator, the scale of the company's debts is not yet clear but a sale of the business is not considered possible and no employees have been retained.

Promixon was founded in 2013 by Marco Marinello, formerly CEO of Plas Mec and part of its founding family. It employed around 50 people.

Plas Mec initiated legal action against Promixon in 2014, according to Plas Mec Managing Director Massimo Grigolon, claiming IP infringement and unfair competition. He said two judgements had already been made in Plas Mec's favour covering certain machinery made and marketed by Promixon.

The most recent judgement was handed down by the Milan court in July last year. Grigolon said it confirmed the earlier court

decisions and awarded damages of more than €4m against Promixon.

No payment has been made to date, Grigolon told *Compounding World*, and the Milan court decision could be appealed. However, whether that will happen is unclear due to the bankruptcy proceedings. "It depends on the bankruptcy trustee which is now taking care of Promixon," he said.

Since the bankruptcy, Marinello has been appointed International Sales Manager at mixing machinery maker Mixaco, according to a post on the German company's [LinkedIn Group](#). > www.plasmec.it

Ube buys US firm PCTNA

Tokyo-based Ube Industries is to buy Premium Composite Technology North America (PCTNA) from Toyota Tsusho Corporation, which established the operation in 2009.

PCTNA is based at Franklin, Indiana, US, and manufactures mostly non-PA compounds for Japanese automotive OEMs and Tier 1 suppliers. It employs 30 people and had sales of \$31.6m in the fiscal year to March 2019.

This acquisition will give Ube its first North American manufacturing site for compounds. It already compounds in Japan, Thailand and Spain.

Ube has previously identified its PA 6 business as an active growth sector and said it is "further strengthening its competitive advantages for extrusion applications while expanding the scope of its business for injection applications."

> www.ube-ind.co.jp

Lanxess reveals new HPM unit head

Lanxess has announced that Frederique van Baarle will become the new head of its High Performance Materials (plastics) business unit with effect from June.

Previously the company's Head of Global Procurement & Logistics, van Baarle replaces Michael Zobel, who has moved to head up its fine chemicals and custom manufacturing subsidiary Saltigo.

> www.lanxess.com

IMAGE: LANXESS



Domo plans Chinese compounding unit



IMAGE: DOMO CHEMICAL

Germany's Domo Chemicals has announced plans for a new €12m compounding operation at DuShan Pinghu city in China's Zhejiang province. Production is expected to begin in Q4 of this year.

The 11,500m² plant will produce 50,000 tonnes/yr of engineered PA compounds when running at capacity. Domo said it will operate at 25,000 tonnes/yr in its first phase.

Domo said the facility will integrate R&D, production and sales. It will produce modified engineering compounds based on PA6, PA66 and high temperature PAs for automotive, electronic and consumer applications in the Asia-Pacific region.

> www.domochemicals.com

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www.coperion.com/sts-mc11-compounder

Ingenia buys LB toll plant

North American additive and colour masterbatch producer Ingenia Polymers has acquired the Bayshore masterbatch tolling operations at La Porte, Texas, US, from LyondellBasell. The deal completed last month.

Ingenia, which is headquartered in Canada and has operations in North America, Europe and the Middle East, said the acquisition "brings added expertise and capacity to its existing world-class team and infrastructure, increases its leadership in the polymer producer services market and expands its capability to serve the converter market".

LyondellBasell acquired the Bayshore business through its acquisition of A Schulman in 2018. It employs around 100 people.

➤ www.ingeniapolymers.com

Unipetrol to invest in chemical recycling



IMAGE: UNIPETROL

Unipetrol's plant at Litvínov in the Czech Republic

Unipetrol plans to build a pyrolytic unit for waste-plastic processing at its plant in Litvínov in the Czech Republic. The CZK72m (€2.6m) Pyrekol project is part of a three-year plan to research and implement chemical plastic recycling within the company.

"Our ambition is to chemically recycle waste plastic not only from our nearest surroundings, but probably from the entire Czech Republic and potentially from other parts

of Central and Eastern Europe within several years," said Tomáš Herink, Board Member of Unipetrol Group. Currently, the Czech Republic recycles about 37% of its 400,000 tonnes/yr of waste plastic and incinerates 18% more for energy generation.

The main focus of the Pyrekol project will be testing different single and mixed input materials for their impact on utilisation rates. However, it will also investigate ways to improve

the quality of liquid and gaseous pyrolytic by-products, as well as methods for storing the liquid to avoid repeat polymerisation and long-distance transportation.

The Technology Agency of the Czech Republic is contributing CZK50m (€1.8m) to the Pyrekol project within its 'Trend' subsidy programme. Unipetrol is also drawing on other government support for the investment.

➤ www.unipetrol.cz

LFT enables spin-on filter first for Hengst



Hengst's Blue.on filter is moulded in Ultramid Structure LFT

IMAGE: BASF

Filtration systems maker Hengst has developed what it claims is the world's first reusable plastic spin-on oil filter module for cars. The new part uses BASF's Ultramid Structure A3WG12 LFX long glass fibre-reinforced high-performance PA. It is 23% lighter than conventional metal oil filters and is said to have a better environmental profile.

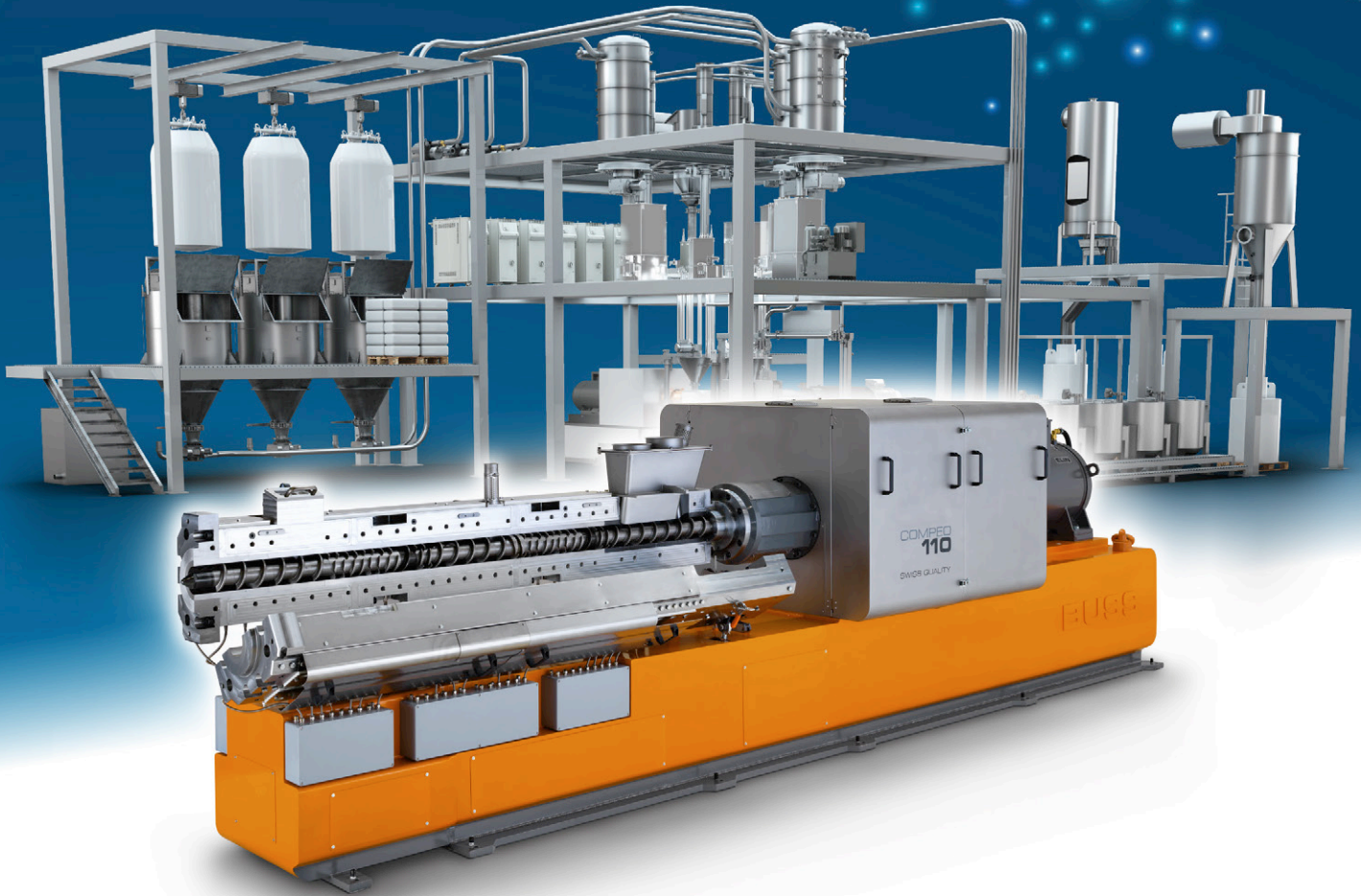
Blue.on, as the new filter is called, comprises housing, connection element and filter, only the latter of which needs to be replaced during a filter change. The LFT housing and connection element remain in place throughout the engine's service life and can be recycled afterwards.

The Ultramid grade used is said to have very good mechanical characteristics at high temperatures, low tendency to creep, and minimal shrinkage and warpage. BASF's Ultrasim simulation tool was used in development of the part to ensure the long glass fibres formed the required 3D network while providing good surface quality.

➤ www.ultramid-structure.basf.com

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EC acts on Circular Economy

The European Commission (EC) adopted its new Circular Economy Action Plan last month, which it describes as one of the main building blocks of the European Green Deal agenda for sustainable growth.

Frans Timmermans, EVP for the European Green Deal, said a fully circular economy is essential to achieving climate-neutrality by 2050, to preserve the natural environment, and strengthening EU economic competitiveness.

The plan puts forward measures to make sustainable products the norm. It focuses on sectors that use the most resources and where the potential for circularity is highest, in particular on electronics, vehicles, batteries, packaging and food production.



IMAGE: SHUTTERSTOCK

For plastics it means mandatory requirements for recycled content and special attention on microplastics, biobased and biodegradable plastics as well as substitution of single-use packaging, tableware and cutlery by reusable products.

■ Meanwhile, the European Academies of Science (EASAC), which brings together scientists from the EU's national science

academies, has published its 'Packaging Plastics in a Circular Economy' report. It warns that current efforts to resolve the plastics crisis are "ineffective and misleading" given how ubiquitous plastics and plastic waste are.

Policymakers and industry must address conflicts in the whole system, from production to end-of-life, EASAC concluded. It argues that fundamental and systemic reforms are

required along the whole value chain and that voluntary and market mechanisms cannot solve the problem alone.

The EASAC report makes seven key recommendations: banning exports of plastic waste; adoption of a zero plastic waste to landfill strategy; extending producer responsibility; ending "misleading" information about bio-based alternatives (it says these create a "false image of sustainability" and reinforce a throw-away mentality); develop integrated recycling systems; limit resin and additive use to improve recyclability; and legislating to ensure virgin feedstock pricing reflects environmental costs.

> <http://ec.europa.eu>
> www.easac.eu

IK hits out at European Plastics Pact

Germany's packaging association *Industrievereinigung Kunststoffverpackungen* (IK) has responded critically to the European Plastics Pact – a partnership of public and private organisations initiated by France, the Netherlands and Denmark – that has published tough new targets for plastic packaging and disposable plastic recycling up to 2025.

The IK said the pact was "pure actionism, raising false expectations and thus doing more harm than good to the recycling industry", adding that it "remains disappointingly vague on the real levers". What is needed, it argues, is not more targets but better design of the framework conditions to ensure that existing ones can be met.

Dr Isabell Schmidt, IK's Managing Director for Circular Economy, said:

"The EU has already set concrete goals in its plastics strategy, the Circular Plastics Alliance is pursuing them with courage, and in Germany the sharp rise in recycling quotas under the new packaging law is already demanding a joint effort along the value chain."

Even the best recyclability, she said, is of no use if authorities do not ensure that plastic waste is collected separately and sent for recycling. IK said that enforcing EU-wide landfill restrictions and extending deposit systems for drinks bottles throughout Europe is vital, but added that the Plastics Pact is "surprisingly soft on these points".

IK also said the Plastics Pact's target of 30% of plastic packaging consisting of recycled materials by 2025 is unrealistic given that regulation



IK Managing Director
Dr Isabell Schmidt
says pact targets
are "pure
actionism"

IMAGE: INDUSTRIEVEREINIGUNG
KUNSTSTOFFVERPACKUNGEN

effectively prevents this in the food sector, which is the main packaging consumer. It also criticised the target 20% reduction in plastics by 2025. That often "means substituting them with non-recyclable paper-plastic composites or glass packaging that is questionable from a climate point of view," Schmidt said.

> <http://kunststoffverpackungen.de>

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*Melissa Jensen-Morgan
Design Engineer, ENTEK Extruders*



Nordson opens pelletiser lab in North America

Nordson has opened a new process laboratory for pelletising systems and melt delivery equipment at its site at Hickory in North Carolina, US, to enable customers to see its BKG systems in operation, evaluate new formulations, carry out application development and train equipment operators.

The laboratory includes a pelletising line with throughput capacity of up to 450 kg/h, including a twin-screw extruder, BKG pelletiser, Optigon self-cleaning process water and pellet drying system, and a jet cleaner for removal of polymer residue from die plates. Melt delivery components include three HiCon screen changers, BlueFlow gear pump and HyFlex diverter valve. It is also equipped to carry out rheological analysis.



Nordson's US team in the new pelletiser lab

Nordson operates a number of process laboratories in Europe, the US and Asia, and already has BKG laboratories in Germany, China and Thailand. The Hickory unit is the first BKG laboratory in the Americas.

■ In a separate move, Nordson has announced a realignment of its global business that will see the creation of two new units: Industrial Precision Solutions

(IPS) and Advanced Technology Solutions (ATS).

The company said its Polymer Processing Solutions division, which includes pelletisers, melt filters, pumps and processing screws, will become part of the IPS business headed up by EVP Gregory P Merk. He has worked at Nordson since 1994 and was formerly EVP of its Adhesive Dispensing Systems operations.

> www.nordson.com

NEWS IN BRIEF...

The German masterbatch association **Masterbatch Verband** has elected a new board. Lifocolor's Dr Martin Fabian was elected to head the association. Performance Masterbatches' Michael Thiessenhusen was re-elected as first deputy chairman and Color Plastic Chemie's Achim Henkel elected second deputy chairman.

www.masterbatchverband.de

Performance engineering plastics distributor **Conventus Polymers** has set up a Mexican subsidiary, Conventus Polymers de Mexico, in Guadalajara. The company has been supplying to multinational OEMs in Mexico for some years. It says having its own legal entity in the country will allow it to strengthen its position and offer a world-class service to local manufacturers.

www.conventuspolymers.com

Russian moves

Sukano has appointed Omya Algol to distribute its PET, PLA and speciality performance masterbatches in Russia, Belarus and Kazakhstan. The move will allow customers to more easily access its products, which are claimed to increase functionality, improve aesthetics and enable recyclability.

> www.sukano.com

> www.omyaalgol.ru

Panasonic opts for Teijin LFT

Panasonic is using a carbon-fibre reinforced LFT from Teijin to manufacture parts for its latest 4K professional video cameras. The PC-based Sereebo material is used to injection mould the handle and top cover of the HC-X2000 and HC-X1500 cameras.

Teijin worked together with Panasonic to develop the application. According to Teijin, the Sereebo LFT material – which combines long carbon fibre in a Panlite PC matrix – provides a short moulding cycle while enhancing strength, reducing weight and improving flame retardance. The parts also display a smooth high quality surface.

> www.teijin.co.jp



Panasonic's latest video camera uses carbon reinforced PA LFT from Teijin

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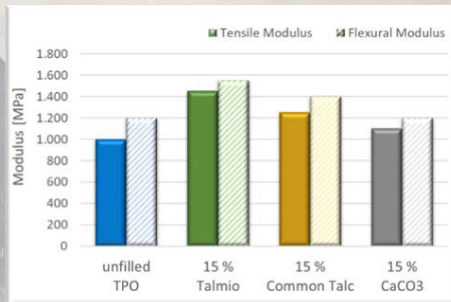
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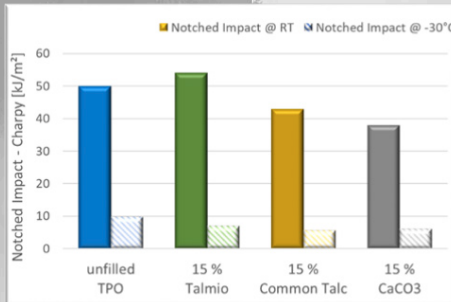
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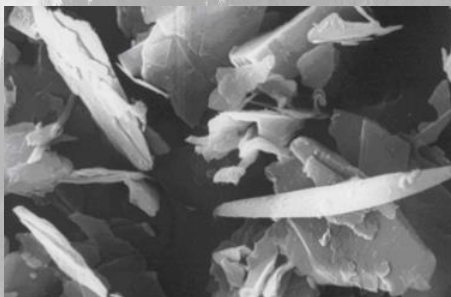
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With compounders being asked to deliver smaller and more frequent batches, it is becoming increasingly important to handle product changes effectively. Peter Mapleston learns how



IMAGE: SHUTTERSTOCK

Making more from smaller batches

As the variety of customer requirements increases and the sizes of individual batches falls, compounders need to be more nimble than ever. They need equipment that is easy to set up and shut down, and that can readily be switched from one recipe to another. They also need procedures that help reduce cleaning times and off-spec material.

When running different products on the same compounding line, following a few simple rules can help greatly in achieving fast product changeovers and reducing machine down time. The strategy of the transition is always important. However, for production of small batches, the flexibility of the compounding machine is also a key consideration as, besides cleaning work, the need to reconfigure screws and line components can lead to longer downtime and overall inefficiency. This article provides some tips from leading equipment suppliers and some recommendations on the best

equipment for small batches.

"Viewing changeovers like a Formula One or NASCAR (depending on your passion) pitstop is what it takes to save your company time and money. It requires an asserted effort and buy-in from management, schedulers, engineers, operators and maintenance to develop changeover best practices and procedures," says **Entek** Technical Processing Manager Dean Elliott.

"Collaborating as a team and having a shared understanding that the equipment needs to be running is essential. Small batch compounding where the lines are running less than 50% of the time creates a huge opportunity to increase uptime," he says. "If possible, create a team environment where it is 'all hands on deck' during the changeover. Batch run order should be from low to high viscosity, as this reduces purge time and cleans out the extruder. Develop an effective

Main image:
With batch sizes getting smaller and recipe variations on the rise, compounders have to become faster and more efficient to remain competitive

Right: Entek's self-aligning screw shafts make for easier installation

purge method that works consistently. Avoid reverse convey elements in the screw design, if possible. These make purging more challenging and time consuming."

An HMI that has a user friendly and easy to access recipe program where formula and run conditions can easily be located and downloaded on to the run screen is extremely helpful, according to Elliott, as operators often waste significant amounts of time trying to locate previous run sheets. "For start-up, software usually allows the operator to input a date, time and temperature profile, this is a good idea as the machine will start heating up ahead of time, so it is ready for the first shift. Also preheating of the gearbox oil in cold climates is helpful."

Fast product changeover was a priority in development of Entek's latest QC³ (Quick-Change, Quick-Clean, Quality Control) twin-screw extruders, according to Marketing and Business Development Manager Tammy Straw. She says the machines are designed so change-overs do not require maintenance staff, allowing the operators to quickly and easily perform them.

Some of the specific QC³ features that facilitate changeovers include: self-aligning screw shafts for easy installation; a quick-change die with easily-replaceable flow channel parts; die heaters and sensors that stay in place while the inner assembly (breaker plate, die plate and die body) is removed to leave an easy-to-clean flat surface; a quick-clean feed chute that extends into the barrel opening so that only the chute needs to be cleaned and not the barrel inlet; and pivoting stuffers that are easy to clean and remove and can access four or five barrel locations.

Below: A user-friendly control interface with easy set-up and recipe storage can help speed job changes

The winning approach

The car racing approach to fast changeover is also promoted by Adam Dreiblatt, Director of Process

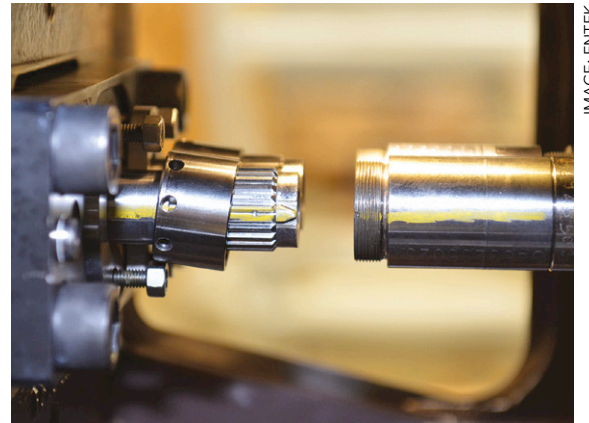


IMAGE: ENTEK

Technology at **CPM Extrusion Group**. "The winner can be decided in the pit stop. The crew has a few seconds to replace tyres, refuel, etc. The vehicle is fitted with specialised features for rapid change and requires highly trained personnel armed with the correct tools to perform these tasks as efficiently as possible," he says.

Compounding extruder operators can learn from that car racing approach. "Extruder components and related auxiliary equipment (feeders, side feeders, vent ports, die plates) that require removal and cleaning between lots can be fitted with captive fasteners allowing for easy disassembly and reassembly," he says.

If screw shafts are to be removed for cleaning or replacement without disassembly, the use of two-piece screw tips will keep the screw elements compressed on the shafts while providing a means to attach the screw removal fixture, Dreiblatt says. "Removing standard screw tips to withdraw the shafts from the machine allows the melt to penetrate between the elements and makes disassembly more difficult. If the next lot requires a different screw configuration, having a second set of assembled screws (already cleaned offline) reduces the time required for disassembly and reassembly. This represents substantial investment which can be recovered quickly by maximising uptime," he says.

"Best practices for changeover between batches where a different raw material is to be used in one or more gravimetric feeders includes re-calibration of the feeder to account for any differences in bulk density. This material calibration procedure is an automated function that allows the feeder to calculate the maximum output and is used to determine the start-up condition," Dreiblatt says.

"If this procedure is not done (for example, to save time), the feeder will start-up at a higher or lower feeding rate and take longer to reach setpoint. Off-spec material is produced until all feeders are running at setpoint and represents yield-loss. This is a critical point for small batch



IMAGE: ENTEK

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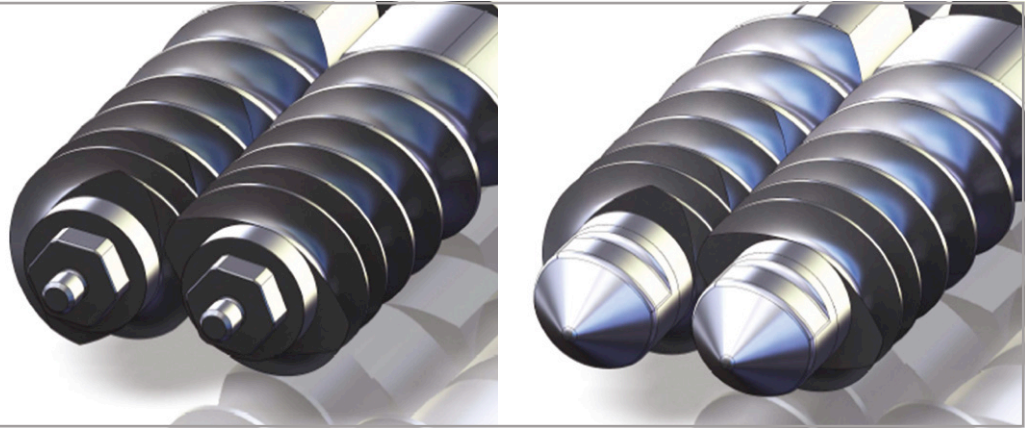
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Two-piece screw tips make for easy and quick removal of screws from the extruder barrel for cleaning. The tip cover is removed (image on the left) to reveal the stud for attachment of a screw pulling fixture while the tip bolt remains engaged to keep the elements tensioned

Source: CPM Extrusion



compounding - to get the machine up and running as quickly as possible," he says.

Dreiblatt adds that providing operating staff with the right tools can dramatically improve changeover time, but points out that while it sounds obvious it is certainly not always the case. "Consider two scenarios. At one compounder, the operator is instructed to clean the machine. They are given a broken screwdriver and bent spatula. As a result, it takes a long time to perform the requested tasks and the operator doesn't feel great about the quality of work. This is because the company did not want to spend money on a few tools.

"At the second compounder, the operator is given an assortment of special wire brushes that are perfectly sized to clean die holes, etc. The procedures specify to use each brush once, then dispose of them. In the end, the cleaning is finished quickly and the operator feels great about the quality of work. Spending money on such things actually ends up costing less in the long run."

Configuration gains

Klaus Hojer, Business Development and Project Manager at **Feddem**, says its compounding

extruders are normally equipped with kneading block-free screws that employ its proprietary FME mixing elements.

"Some of Feddem's customers produce 80% of their engineering plastic compound recipes on one screw configuration, saving a considerable amount of production time by minimising the frequency of exchanges of processing screws," he says. The benefit of this arrangement is shown graphically in Figure 1.

The wide-range performance of screw geometries using FME mixing elements allows production of the same high product quality on different Feddem extruder sizes, Hojer says. "In production setups with different sizes of Feddem extruders a production job can be matched to the best suited extruder. The ratio of 'duration of the production run' to 'unavoidable start-up/shut-down losses in raw materials' is optimised and idle times of the extrusion lines through screw exchanges are avoided. The quality of the produced compound is the same."

Feddem's compounding extruders are also available with modular extensions of the processing section. The company says conversion from a shorter to a longer length can be executed through the use of one or more extension kits, each 10 L/D long, within a few hours. This means the processing length of the extruder can rapidly be adapted to the requirements of the process.

Another machine feature that is claimed to contribute to faster product changeovers is Feddem's FSK die head. This features a curved die plate that is claimed to relax the melt flow to the die holes across the width of the plate and equalise differences in flow speed between holes. "Some customers report that it takes only 50% of the time during production start-up to reach stable strand performance compared to start-ups with conventional straight die hole arrangements," Hojer says. Feddem says the FSK die heads can be customised to fit extruders of other brands.

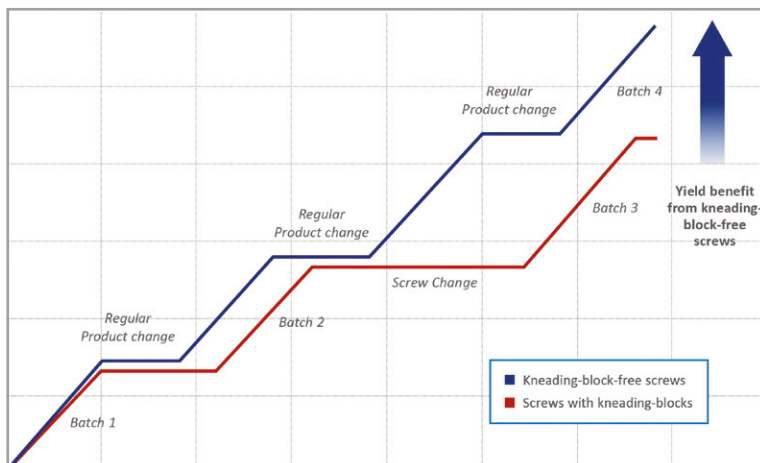


Figure 1: Yield comparisons for compounding extruders equipped with kneading block and kneading block-free screws

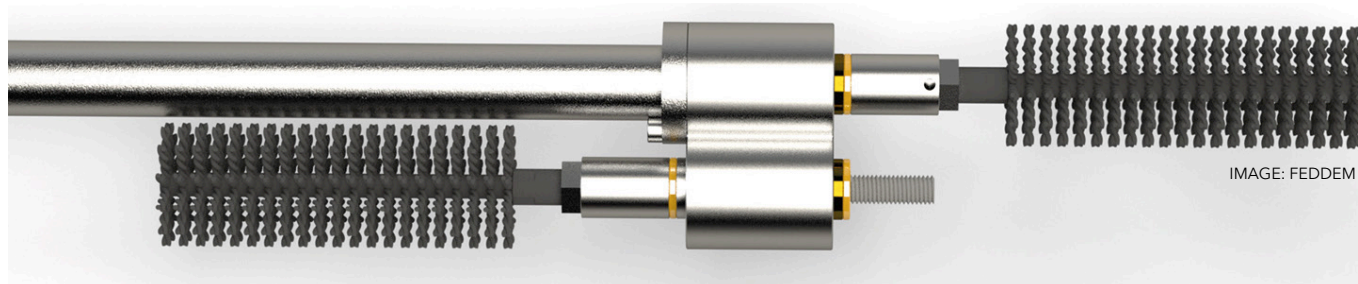
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Above:
Feddem's FRE cleaning unit with dual brush configuration can speed product changes

The company's FRE dual brush cleaning unit can also help to shorten cleaning times, Hojer claims. After the screws have been removed and barrel openings plugged, the cleaning unit can be inserted directly into the figure-eight-shaped barrel bore without reducing the temperature. After a few movements back and forth along the barrel borings, the company says the extruder can be recommissioned.

The latest compounding and pelletising system from **Steer** – the SPL 40 – is said to be dedicated to lean manufacturing production environments. "What makes the SPL 40 unique are its features, high efficiency and attractive investment cost," the company claims. The system comprises a co-rotating twin-screw extruder with feeder, strand die head, water trough, air knife, pelletiser and classifier. Steer says it is built with the emphasis on reliability and safety to cater for the particular needs that arise from unscheduled/unplanned orders for small quantities and the associated requirement for better control over work in progress (WIP) during grade changes.

According to Steer, the SPL 40 is capable of developing and testing new formulations as well as for scale up for commercial production. It comes in a standard design that offers simplified operation with a universal screw configuration suitable for most polyolefin and styrenic compounds. The company says the focus of the machine development has been to ensure minimum set-up and change-overtime and maximum 'first-pass-yield'.

The kneader option

One fundamental question that compounders carrying out short runs on a regular basis may ask themselves is: "Should I be using twin-screw extruders or kneaders?" Companies such as Buss and X-Compound – both manufacturers of kneader extruders – recommend the latter.

Flexibility is an intrinsic characteristic of kneader extruders, says Francois Loviat, Head of Process at **Buss**. "As an example, Buss managed in our test centre to run three very different products on a kneader without any modifications to the machine configuration. In this way, switching between two products could be done within a couple of hours. Those three products were a TPU, a polyolefin and a halogen-free flame retarded cable compound. The ability to run those products on an identical machine configuration was of significant value to our commercial partner, who awarded Buss with an industrial project."

The most challenging changeovers are from high viscosity materials to low-viscosity ones, and from black compounds to white. So, in general, it is advisable to run different formulations in a sequence going from low viscosity to high viscosity and from white to dark. "When switching from a compound containing carbon black to a white product, the most efficient method is usually to run the kneader empty, open it and clean it mechanically," says Buss Senior Process Engineer Andreas Niklaus.

Moving from a high to low viscosity material may be achieved using some appropriate purging



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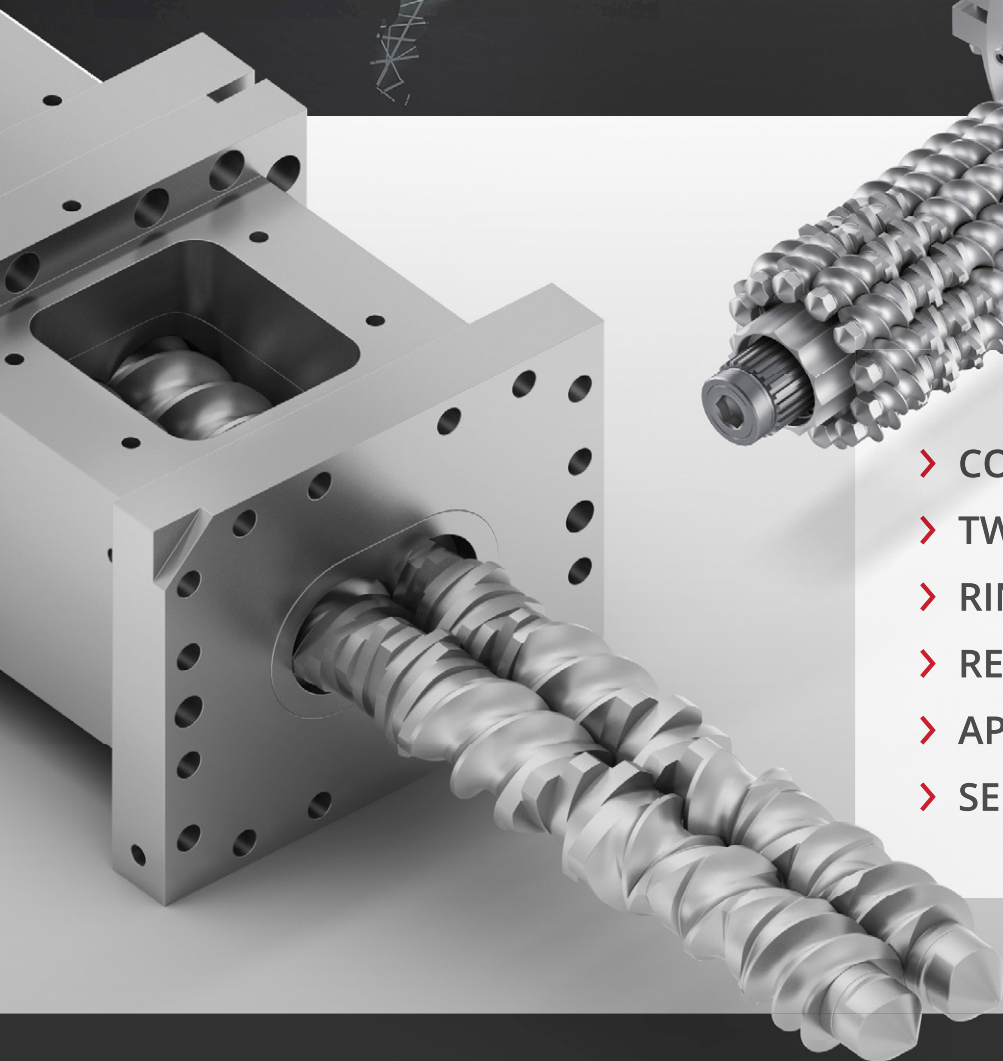
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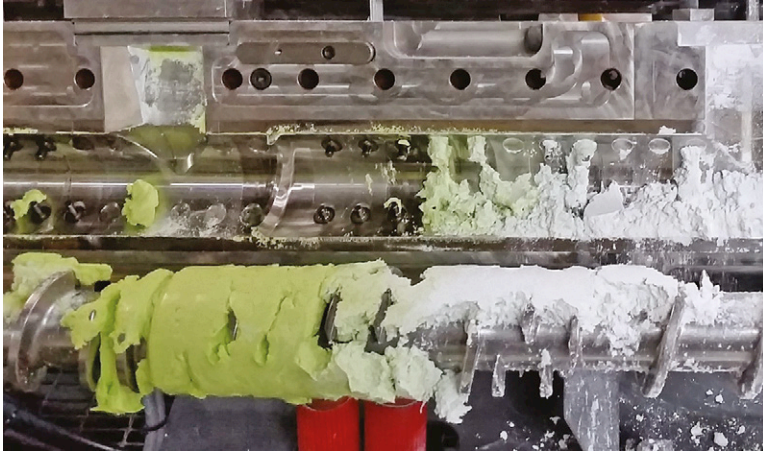
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IMAGE: BUSS



Above: Buss kneaders allow liquids to be injected at any position and to be mixed efficiently over a very short distance. This image shows a yellow colour mixed in PVC

compounds, with mechanical cleaning a good alternative. In some cases, the processing temperature can be reduced to a level at which the polymer becomes rubbery so, if the material is not sticky, it can be removed relatively easily.

When working with liquid colorants, it is generally possible to inject the colour very close to the end of the machine, Niklaus says. Buss kneaders allow liquids to be injected at any position and to be mixed efficiently over a very short distance – often just a couple of L/Ds. This strategy can enable fast product transitions by purging as only a very short section of the machine is “contaminated” with colour.

Feeding considerations

It’s not only the core compounding equipment that should be optimised for quick product change. The same applies to up and downstream equipment, from raw material handling to the packaging system, Loviat points out. “Ideally, each raw material should be dosed into the machine with a dedicated

dosing system in order to avoid product change in the gravimetric feeders,” he says. This is because changing product in the gravimetric feeder usually means it must be emptied, dismantled and cleaned, which can be time consuming and result in considerable line downtime and lost production.

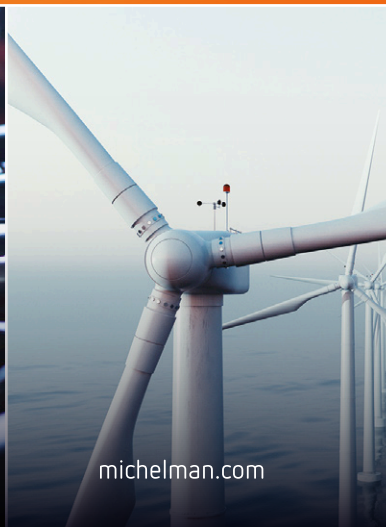
Loviat acknowledges, however, that it is often not possible to dose each single raw material with a dedicated feeder for cost or space reasons. A compromise may be required. “In general, pellet dosing units can be run empty and do not require much cleaning while switching product. It is, therefore, usually a reasonable trade-off to use the same gravimetric units for dosing different pellet raw materials.”

The situation is different for powders, though, as some cleaning is generally required when switching products. Where space is the main issue, Loviat says powder components can be dosed with dedicated gravimetric feeders mounted on a carousel or on rails. This allows unused devices to be placed in a remote “stand-by” position.

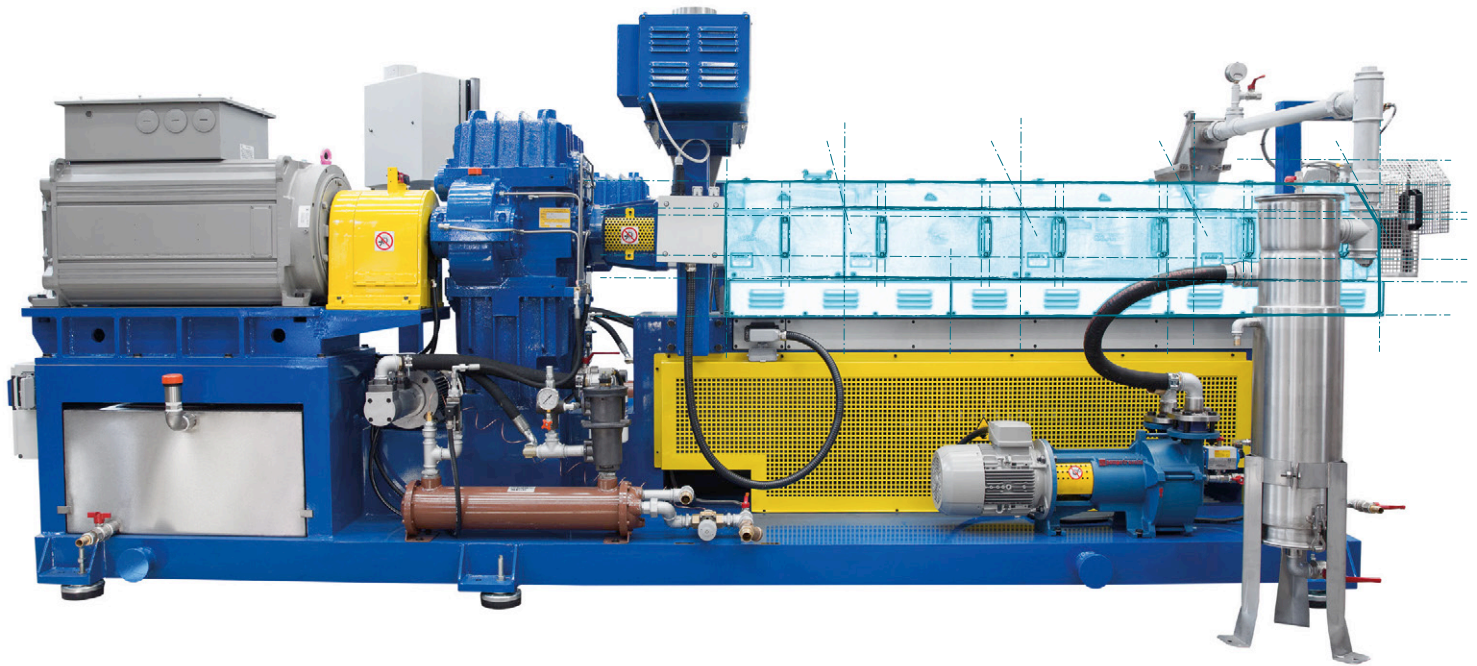
“In case product changes in the gravimetric feeders cannot be avoided, one should pay attention to the design of the equipment and focus on features making the cleaning of the equipment faster and easier,” he says. “Units assembled with clamps instead of screws are usually easier to dismantle for cleaning. Agitators fixed in the wall of the material hopper instead of the cover are also of advantage. Furthermore, it is in some cases possible to exchange only the raw material hopper of the feeders, keeping the same weighing system. This limits the amount of cleaning work to the minimum.”



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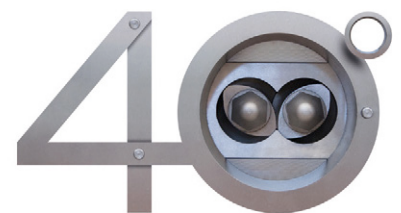
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Quick change-over feeder options

Coperion K-Tron says its “Quick Change” feeder line is well suited for compounders running small batches with varying formulations and frequent product changes. Specially designed for applications requiring the maximum possible material handling and changeover flexibility and cleaning capability, Quick Change feeders are said to allow a change from single screw feeding bowl and screws to twin screw feeding bowl and screws in just minutes, allowing one feeding station to handle a wide variety of materials.

T35/S60 Quick Change Feeders are available in volumetric or loss-in-weight configurations. The feeder bowl can be quickly

decoupled from the feeder drive, enabling simple and fast product changes, while all twin and single screw feeder models can be interchanged on the same base to reduce cost and increase flexibility.

The modular design of the Quick Change feeders also provides the flexibility to reconfigure or expand a production line at a future date, Coperion K-Tron says.



IMAGE: COPERION

The company says that the single-screw feeding elements are typically better for handling free flowing powders, granules, pellets and other non-flooding materials, while the twin screw elements control floodable powders and more difficult, sticky or hard-to-flow materials.

In addition, all Quick Change feeder parts in contact with the material being fed are manufactured in durable stainless steel while the absence of flexible liners is said to result in reduced maintenance.

> www.coperion.com

Left: Coperion K-Tron’s Quick Change feeders are said to offer simple changeover from single screw to twin screw configuration in minutes

Thinking smaller

Kneader producer **X-Compound** says it is addressing the growing demand for small batch production with a range of small and medium-capacity lines. These complement the larger X-Compound Continuous Kneader lines and include the same main features. This ensures easy and safe scaling of a process in both directions – from small to large scale as demand increases as well as the other direction if demand decreases – while maintaining the same level of final product quality.

The smallest line, the CK45, has a process section that is all liquid tempered, including kneader and discharge screw. “This is exactly the same approach as in the currently largest Continuous CK Kneader, the CK240,” says Karsten Kretschmer, Head of Machinery Sales. “Although the line was developed as a lab compounding line for formulation and process development, a significant number of machines are today used for small scale production of various compounds, from commodity cable compounds to specialty compounds

produced using reactive extrusion.”

The reason for increasing use of the CK45 is its combination of flexibility and efficiency, Kretschmer claims. “Numerous formulations can be processed with no or only minor adjustments of the configuration. If required, changes can be performed in a very short period of time,” he says.

Kretschmer also highlights the value of the unit’s specially designed restriction rings, which can be replaced without changing the barrel liners, among the machine’s time saving features. “Continuous kneaders are well known for their excellent self-cleaning,” he says. “If ever manual cleaning is necessary, the barrel clamp shell design allows a quick access to all process parts. Thus, batches of a few to some hundred kilos can be produced very efficiently.”

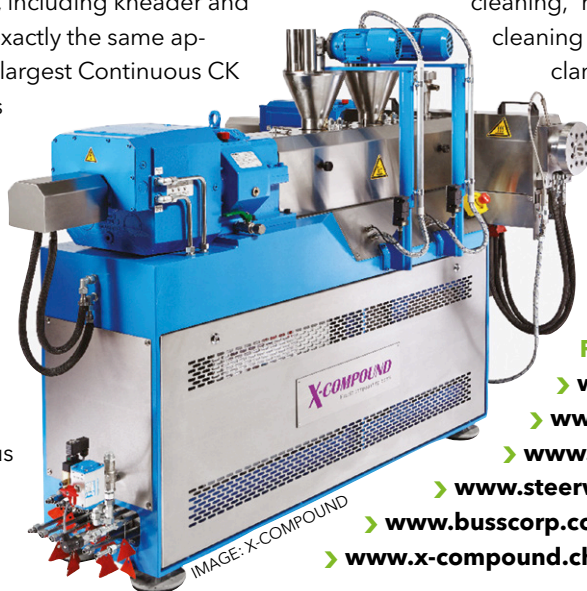


IMAGE: X-COMPOUND

Right: X-Compound’s CK45 kneader is designed for small batch and development applications

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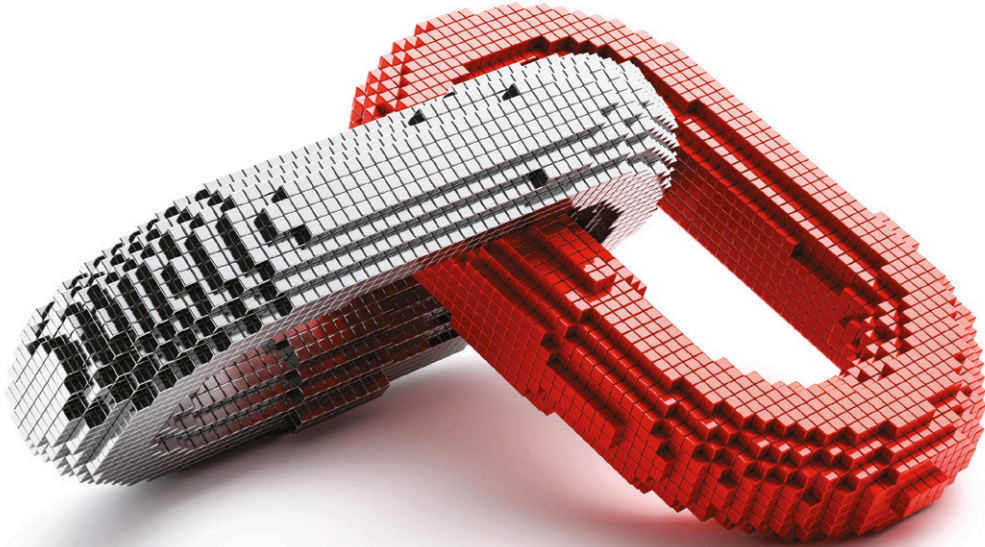
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Morphological modification as an enabler for impact copolymer PP

Morphological modification is a powerful tool for improving mechanical performance of impact copolymer PP (ICP). Zdeněk Buráň, from Unipetrol RPA - Polymer Institute Brno, explains more

Passenger cars and light commercial vehicles produce around 14% of total CO₂ emissions in the EU. The recently introduced EU Regulation (EU)2019/631 addresses that by setting demanding CO₂ emission performance standards for new passenger cars and light commercial vehicles. One way car makers can meet these new targets is to reduce vehicle weight, but replacing steel parts with plastics requires high quality polymer materials with excellent mechanical properties.

Impact copolymer PP (ICP) combines the stiffness of PP and toughness of EPR (ethylene propylene rubber) and is a key polymer material used in many industrial sectors, including automotive. It can be employed alone or as the main component of a compound. The research team from Unipetrol RPA - Polymer Institute Brno has been working to improve the mechanical properties of ICP by modification of its morphology. This research was targeted on understanding how morphology can affect the ICP properties.

Dispersion of the EPR particles in the PP

matrix — as well as their particle size — is a crucial parameter affecting toughness and other properties. The optimum particle size can be achieved by adjusting the viscosity ratio of the two basic components — the rubber and PP homopolymer. The size of the EPR particles can also be controlled by the ethylene-propylene copolymer composition.

ICP stiffness can also be increased using suitable nucleating agents (NA). Inducing a greater number of nuclei leads to a decrease in spherulite size and an improvement in morphology of the

homopolymer PP matrix. The increased crystallisation rate connected to the increased nuclei number has a strong influence on ICP stiffness. Some NAs affect not only stiffness, but also toughness (Figure 1).

The results of this project have been applied by Unipetrol in the development of a new high melt flow ICP material with high stiffness and toughness. Compared to former ICP materials, this new material shows enhanced toughness and stiffness especially in thin wall injection moulding applications (Figure 2).

Figure 1: Influence of some nucleating agents on mechanical properties (compared to a non-nucleated reference)

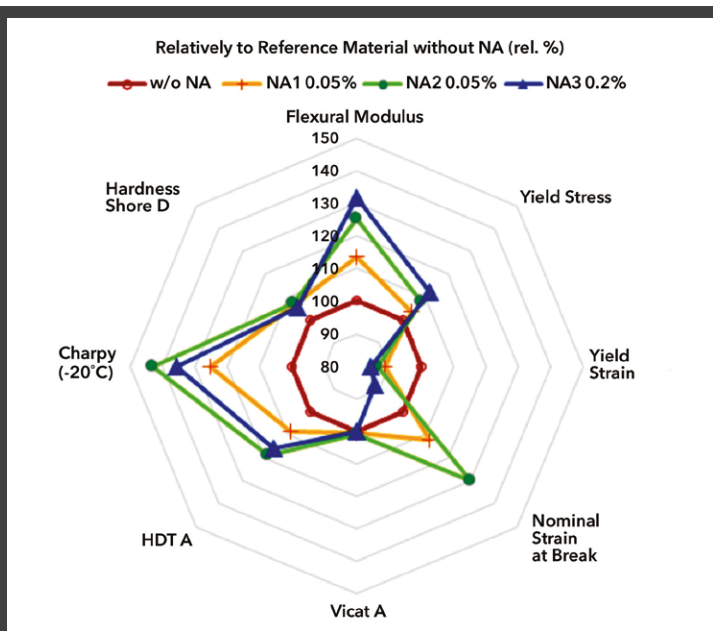


Figure 2: Properties of newly formulated ICP material in a thin wall injection moulding application

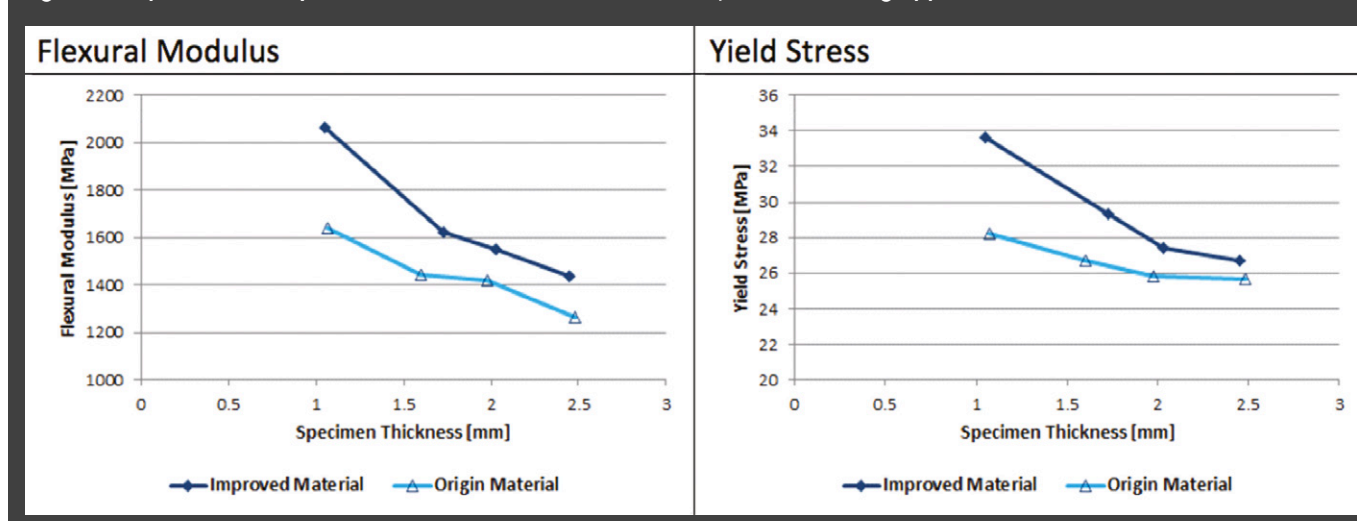




IMAGE: SHUTTERSTOCK

Realising the electric dream

The conversion to electric vehicles is a huge change for carmakers. It will also mean big changes for plastics compounders. Mark Holmes explores the opportunities at hand

The move to electric vehicles (EVs) is the biggest challenge the global car industry has faced for decades. The investment required will be huge while the new powertrain technology will make much existing plant and equipment redundant. The automotive supply chain is about to be reshaped, which will bring with it challenges and opportunities. Not the least for plastics suppliers and compounders.

EVs will place new performance demands on polymer compounds. EV polymers will be required to handle much higher voltages, offer higher levels of flame retardance, and – contrary to what may be thought – withstand elevated operating temperatures for longer periods (EV cooling systems, for example, must work both while the car is being used and while it is being charged.)

However, EV opportunities for plastics don't stop at the powertrain. One of the biggest challenges for EV developers is range – how far the car can be driven on a single charge. And that is not just about batteries but also weight. Interest in lightweighting technologies – many of which use sophisticated plastics – will only intensify. Meanwhile, EV technology lends itself to autonomous and semi-autonomous driving technologies and demand for

increasingly sophisticated, low cost sensors will grow.

The most obvious – literally – polymer development is the growing number of orange compounds used in EV powertrains. "In powertrain electrification systems, any live parts carrying more than 30V AC or 60V DC are a potential electric shock hazard. These parts must be instantly recognisable to alert production line employees, after-sales personnel and car owners," says Hubert Ruck, Global Director New Mobility at **Domo Chemicals**, which acquired the former Solvay Technyl business at the beginning of this year.

Developing formulations that provide the required high colour stability for long term periods of exposure at elevated temperature is not an easy task, but it is achievable. Domo's Technyl Orange grades have been developed for applications such as cables, connectors, charge plugs and sockets, converter housings, sensors and insulators. They are available in RAL 2003 for vehicles in Europe and RAL 2008/2011 for exports to North America, with the range using the company's halogen-free Technyl One and Technyl Star formulation technologies to provide UL94 V-0 flammability ratings at wall thicknesses as low as

Main image: Orange connectors and cables are the most obvious EV application for polymers but the new powertrain and vehicle architecture will present a whole raft of opportunities

Right: Witcom Engineering Plastics has developed a 3D printable version of its radar absorbing material

0.4 mm. All grades are said to offer very good colour stability, low mould deposits and a comparative tracking index (CTI) of 600V or greater.

Connected thinking

Lanxess has also developed a range of orange coloured compounds for EV applications. The company recently announced RAL 2003 grades for the European market but said it is developing products for other global markets. The materials will be available in standard or heat stabilised versions. Standard versions provide acceptable colour stability after ageing for 1,000h at 130°C; stabilised versions exceed 1,000h at 150°C.

“We want to provide a Yellow Card listing from the US testing organisation Underwriters Laboratories for all the compounds we offer, which means that the moulders will not have to colour the product themselves nor to undergo the time-consuming UL certification process. They can deploy the compounds instantly, which helps to cut costs,” says Julian Haspel, manager of the e-Powertrain team within the Lanxess High Performance Materials (HPM) business unit.

First products include halogen-free flame retarded Durethan PA6 grades with between 20% and 45% glass. Lanxess says the 45% glass reinforced BKV45FN04 grade is of particular interest in EV applications where its high flow and UL 94 flammability rating of V-0 at 0.4mm makes it a good choice for structural battery components such as cell frames and end plates as well as large, high-voltage connectors. A hydrolysis-stabilised glass reinforced Pocan PBT is also part of the new product series. It is said to meet the hydrolysis resistance requirements of the long-term SAE/

IMAGE: WITCOM ENGINEERING PLASTICS



USCAR-2 Rev 5 plug connector test, passing the strictest Class 5 level.

As a significant producer of specialised compounds for EVs, **Witcom Engineering Plastics** says there are some specific technical challenges to overcome. The increased use of sensors and electronics calls for electrical shielding. The absence of engine noise means there is a greater

requirement for low friction bearing and gear materials to maintain a quiet cabin. And the need to incorporate heavy battery packs raises demands for lightweight high strength materials with enhanced thermally conductivity for casing applications.

Witcom claims to be a global leader in radar absorbing thermoplastics with a product range in this area that includes PA, PP, PBT and PC. “With the advent of autonomous driving, electric vehicles are equipped with many radar sensors that provide the input for guiding the vehicle,” says Udo Schwestka, Global Business Development Manager for Witcom. “The brackets used to mount these sensors have to be invisible to radar waves. Any radiation should be absorbed rather than reflected, as reflections show up as false images on the radar (ghosting).”

Shielding solutions

Schwestka says EMI shielding is another key development area. “We are currently working on adapting our range of radar absorbing materials to shield against a wider spectrum of electro-magnetic radiation. Our radar absorbing materials function in the frequency range over 10 GHz and we are now addressing the range from 1-10 GHz.”

As radar components often undergo several major design changes during development to optimise the radar absorbing qualities, the company has developed a 3D printable option. “This type of development demonstrates that we provide a strong service package to our customer, which includes these types of limited volume products as well as very specific material data and design support,” he says.

Witcom is also offering lubricated grades. Its POM compounds offer low slip and good sound damping properties, making them well suited for the quiet interior of an electric vehicle. The materials also meet increasing environmental demands – they do not contain PTFE so do not have any perfluorooctanoic acid (PFOA) issues. The absence of PTFE also means there are no issues with formaldehyde and other volatile organic

Below: A variety of EV connectors made in Technyl Orange PA grades from Domo Chemicals

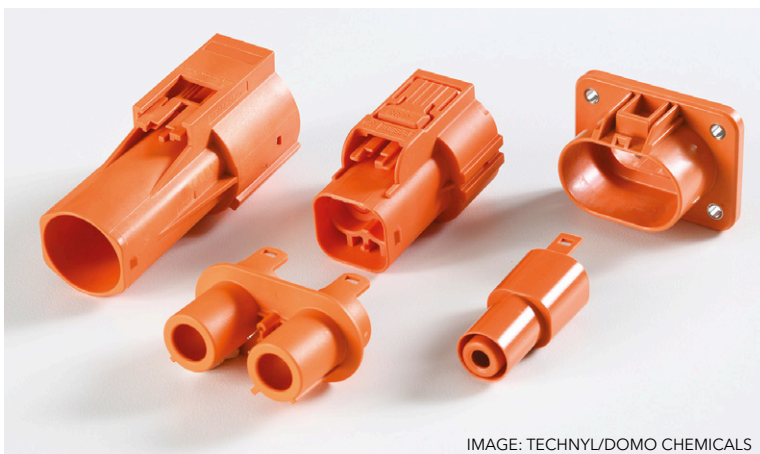


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compounds outgassing, the company claims.

Schweska cites its recent development of a lubricated PEI for the bearings of an electrically operated spoiler. "The spoiler operation needed to be silent over an entire temperature range from -40 to +90 C," he explains. "In order to achieve this, we used a special lubricant system and modified the material so that the thermal expansion matched the metal components. The material also needed to be electrically conductive, because the spoiler assembly is suspended from the bearing during electrostatic painting."

Lubricated PEI bearings developed for an electrically-operated spoiler by Witcom



IMAGE: WITCOM ENGINEERING PLASTICS

Flame retardance

BASF has developed a number of high performance plastic compounds for EVs, adding that the speed at which performance, weight, safety and efficiency of electric drive trains can be optimised will be a crucial factor in the success of electromobility. It says flame retardant plastics, in particular, will be required to enable savings to be made in terms of the weight and installation space required for high-voltage components.

Current electronic drive systems are still primarily part of the metals industry, according to BASF. Until now, manufacturers of electric motors and power electronic components have been using housings made of steel or die-cast aluminium but, as many of the components are now actively cooled, plastic solutions are now a possibility for lightweight construction. It says its flame-retardant Ultramid grades A3U42G6 and B3U50G6 would be contenders for such applications.

Housings that contain high-voltage electric components must also be electrically shielded to prevent compromising the surrounding area and metal coatings on the plastic housing parts are one

of the possible solutions that BASF is pursuing. In prototype projects with customers, it says it has been able to show that plastic housings manufactured using this process are lighter and more economical than comparable die-cast aluminium housings.

In addition to electromobility, BASF adds that highly automated driving will also revolutionise tomorrow's vehicles and the number of sensors will increase significantly. It says it has already made a significant contribution to a number of sensitive electronic sensor technologies with its range of hydrolytically resistant PBT grades. However, it believes the the increasing level of automation will also see new sensors, such as radar, lidar (light detection and ranging), IR and ultrasonic sensors, find their way into cars.

Celanese says its polymers are providing effective and sustainable solutions for a variety of under-the-hood, interior and exterior parts for EVs. It says these range from improving battery performance, to lightweighting battery housings and thermal management. It is also targeting Passive Automation Driver Assistance Systems (ADAS) components such as cameras, radar, lidar, and high speed data connection systems.

Beyond the technical

However, Celanese says the focus should not be all technical – driver experience and flexibility of interior design is another key area of application for plastics. As vehicles see increasing and more severe usage of interior control and communication systems, carmakers will require durable surface materials at lower cost that do not sacrifice appearance and quality. It says its MetaLX mould-in-colour polymers are one solution, offering designers and engineers high gloss and matt finishes, UV resistance, and scratch and mar protection.

The company also highlights increased demand for recycled solutions. In addition to the ongoing

Below: Electric drive makers are yet to explore the full potential of plastics, according to BASF

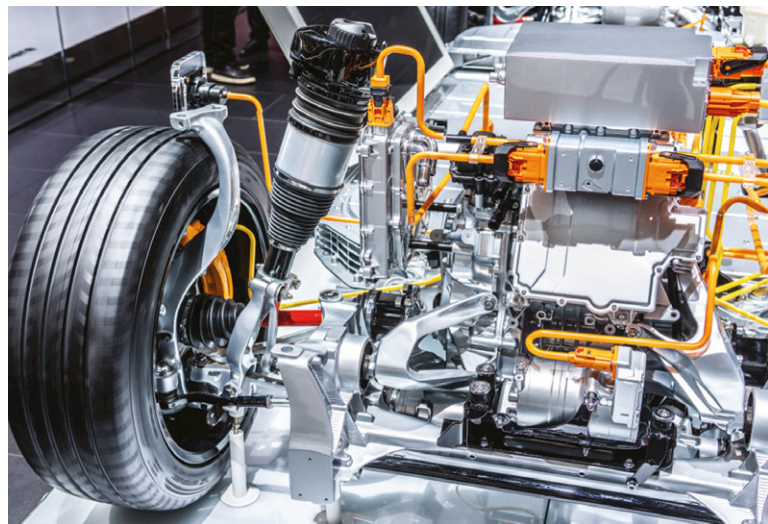


IMAGE: SHUTTERSTOCK

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Clariant targets new data connectors

Clariant Masterbatches has developed a range of colour masterbatches that comply with the new FAKRA standard for high speed automotive data connectors, which the company says will be introduced on European models from 2021.

Named after the German industry group that developed the standard, FAKRA connectors provide 6GHz of bandwidth to handle 5G cellular/data traffic and are intended to support next generation automotive monitoring, diagnostic, safety, performance, navigation, and entertainment systems. The standard details 14 standard plug/jack combinations, each assigned with a specific colour, function and coded mating configuration.



FAKRA connectors will be produced using high-temperature-resins such as PA66, PBT and PPA because they will typically be fixed to printed circuit boards (PCBs) using lead-free reflow soldering at peak temperatures of up to 260°C. The new Clariant masterbatches are formulated for with these high temperature polymers and

others and are halogen and SVHC-free.

The company can supply the new masterbatches from its production plants in Germany, China and the US.

“The market for FAKRA-compliant coloured resins is in flux, with connector makers seeking reliable, colour-stable supplies but in relatively low quantities. Moulders are typically not yet able to commit to the large

volumes that resin makers supply, especially in the initial stages of production or for the smaller colours’ production,” says Peter Dufour, Global Segment Head and Business Development for Consumer Electronics, Electricals and Electronics at Clariant Masterbatches.

> www.clariant.com

trend to lightweighting solutions and the shift from metal to plastic, it says it will also be necessary to meet OEM recyclability goals with polymer solutions that replace prime material with eco-friendly recycled grades. Celanese says that it offers new polyamide solutions that use high quality recycled PA feedstocks that provide a good balance of strength, ductility, temperature stability, processing window and good lot-to-lot consistency.

Continuous growth

In addition to the coloured connector compounds highlighted earlier, **Lanxess** also aims to contribute to the EV market with its Tepex continuous fibre-reinforced thermoplastic materials. Tepex is already being used in lightweight structural components in passenger cars, with a recent example in a lightweight hybrid A-pillar developed by Porsche for use in convertible and roadster models. It is being employed for the first time in the Porsche 911 Cabriolet.

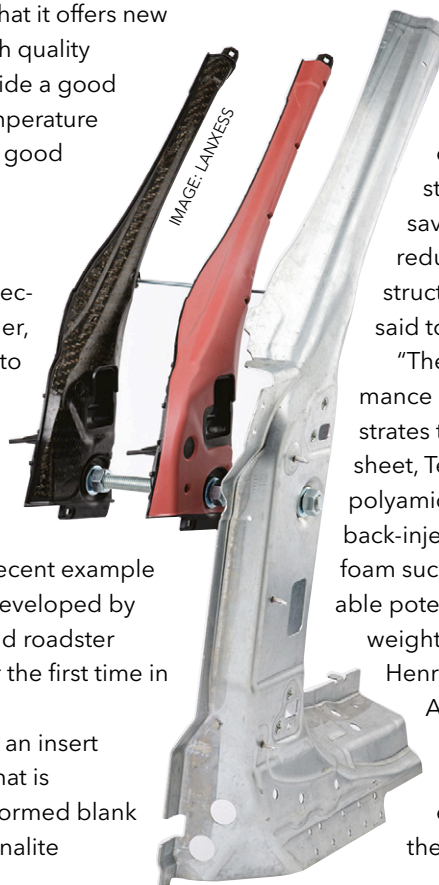
The hybrid A-pillar comprises an insert made from high-strength steel that is supported from the inside by a formed blank made from PA6-based Tepex Dyalite

102-RG600(6)/47% sheet reinforced with a ribbed structure made from Durethan AKV30H2.0 short glass fibre reinforced PA66. The entire structure is bonded together using L-5235 structural foam developed by L&L Products.

The strength and rigidity of the hybrid insert means the A-pillar meets the rollover performance of the previous high-strength steel tubes solution with a weight saving of 5kg. As this weight reduction is high in the vehicle structure, driving dynamics are also said to benefit.

“The excellent mechanical performance of the hybrid A-pillar demonstrates that hybrid inserts based on steel sheet, Tepex blanks, polyamide 6 or polyamide 66 variations of Durethan as a back-injection material, and on a structural foam such as L-5235 also offer considerable potential for use in structural lightweight vehicle body design,” says

Henrik Plaggenborg, head of Tepex Automotive at the Lanxess High Performance Materials (HPM) business unit. “That applies to electric vehicles in particular as their heavy batteries give them a



Right: The weight saving potential of this hybrid plastic-steel pillar construction is expected to appeal to EV builders

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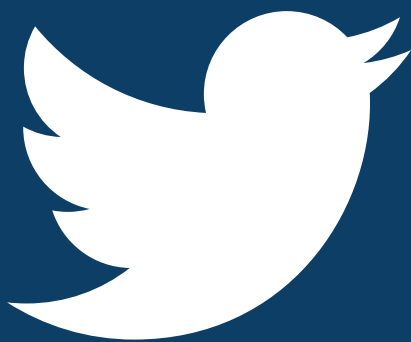


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IMAGE: COVESTRO

Above: Backrests for the front seats in the ENO.146 concept EV are made using Maezio carbon-fibre reinforced thermoplastic from Covestro

high impact mass. The weight reduction also extends the range of the electric vehicles that use this technology.”

The hybrid composite elements are developed and manufactured by L&L Products at its site in Strasbourg, France. The first step in the manufacture of the reinforcing elements involves forming and overmoulding the Tepex blanks using hybrid moulding technology. The resulting composite component is then coated with an epoxy-based thermally-reactive foam bonding system and mounted on the steel body before the cathodic dip coating (KTL) process. The high temperature during the KTL process cause the structural foam to expand and bond with the high-strength sheet steel, which is also fixed to the A-pillar casing, to produce the reinforcing hybrid insert.

Other potential applications for the hybrid composite elements include reinforcing cross members and side members, B and C-pillars, load-bearing battery parts and door components that are critical to safety.

Structural opportunity

At K2019, **SABIC** highlighted the structural lightweighting capabilities of its Xenoy HTX with the example of a 3D printed prototype rocker panel reinforcement designed for electric vehicle battery side protection. When exposed to temperatures of -30°C, SABIC says that many engineering plastics tend to become brittle and fracture under load. Xenoy HTX can deliver low-temperature ductility and a high elongation that enables stable performance under such conditions. In addition, new formulation technology is said to provide enhanced flow, resulting in greater design freedom for complex geometries and cost-efficient part consolidation.

The company says hybrid honeycomb designs using Xenoy HTX could potentially save up to 60% of the weight normally associated with traditional all-metal, multi-piece steel or extruded aluminium crash counter-measures without compromising on dimensional stability, rigidity and mechanical strength. The glass-filled grades are claimed to be particularly suitable for demanding body-in-white structures that must be capable of enduring e-coating cycles of 30 minutes at temperatures between 180-220°C.

The HTX grade can also be used to produce other structural parts subjected to high service temperatures, including front-end modules, front brackets and under-the-hood components. SABIC says the lightweighting potential of the compound can offset some of the substantial additional weight of battery modules in EVs.

Covestro is also placing development focus on lightweight composite constructions, some based on its Maezio continuous fibre reinforced polycarbonate materials. A lightweight table

Padanaplast aims for battery flexibility with new XLPO grade

Italy’s Padanaplast, which specialises in silane-crosslinkable flame retardant polyolefins for the wire and cable industries, sees the demanding technical specifications for EV applications as a growth opportunity.

The latest addition to its range is an experimental grade

– Cogegum GFR 1709-27 – targeted at T4 battery cables requiring high flexibility. The compound joins a Cogegum line-up that also includes two grades that comply with ISO 6722 Class C and SAE J1128 specifications for T3 cable primary insulation – GFR 1401-76 and GFR 1401-190.

Padanaplast also offers the

Polidiemme G family of compounds that are compliant with EN 50620 and suitable for use in flexible cables for EV charging applications.

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Right: Padanaplast sees EVs presenting opportunities for XLPO-HFFR cable compounds



IMAGE: PADANAPLAST/ISTOCK



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IMAGE: EMS-GRIVORY



Above: The RADOX HPC rapid charger from Huber+Suhner uses PA compounds from EMS-Grivory

prototype shown at K2019 addressed the perceived shift in emphasis in future automotive interiors from driving to traveling environments. It combined Maezio sheet with the company's Baynat PU-based acoustic foam.

The company has also partnered with the Research and Development Center of Guangzhou Automobile Group (GAC R&D Center) to develop a lightweight composite seat back for the Chinese car manufacturer's latest electric concept car, the ENO.146.

With a drag coefficient of 0.146, GAC says the ENO.146 is one of the most aerodynamically efficient vehicles in the world and aims for an NEDC (New European Driving Cycle) range of 1,000km. While the aerodynamic design is key to achieving that performance goal, the GAC R&D Center also uses lightweight materials to reduce weight. The backrests of the two front seats of the concept car are made from Maezio carbon-fibre reinforced thermoplastic, which is estimated to save up to 50% in weight compared to typical metal constructions.

The car will become a multifunctional, mobile living and working space. The concept focuses equally on functionality, comfort and design, but also on efficiency and light weight. The focus is on multi-sensor infotainment systems, innovative seating concepts, smart surfaces and personalised lighting.

Other Covestro developments include an integrated, three-dimensional multifunctional large-format display concept produced using In Mould Decoration (IMD) and Film Insert Moulding (FIM) technology and its Makrolon AI PC compounds and Makrofol PC film. It says that polycarbonate films may serve as a mouldable carrier for printed electronics, enabling the integration of additional functions.

Cooling performance

Automotive electrification opens up new fields of application for high performance polymer compounds, according to **Evonik**, which offers PA12, PI and PEEK materials. It says both hybrid and fully electric vehicles require highly effective cooling systems, not only for the high-voltage battery but also for other essential high-voltage components such as the motor and converter or inverter. In addition to mono-layer tubing based on its Vestamid PA12, Evonik has developed its MLT 8000 multilayer tubing system for such thermal management applications.

The company also sees opportunities in motor and drive systems. Specialised products such as Vestamid PA12, P84NT PI and Vestakeep PEEK compounds allow manufacturers to produce durable components, such as bearings or gears. Their use reduces friction for efficient, long-term use and eliminates noise and vibrations.

Quick charging times are also the key to successful electromobility. New standards allow for charging up to 350 kW, which reduces charging time to minutes but places high demands on materials. The company says its flame-resistant Vestamid PA12 and durable Vestakeep PEEK are suitable for use as insulation for cables or busbars in the battery module or electric motor, and as plug components for the high-voltage charging and on-board system.

Long glass-fibre reinforced Grivory GVL-4H V0 and Grilamid L PA grades from **EMS-Grivory** are being used in a rapid charger developed by Swiss cable company Huber+Suhner. The RADOX HPC high power charging system operates at up to 400A and 1000V, which allows the batteries of larger electric vehicles to be charged to 80% in less than 15 minutes. It is already in use in North American and European rapid charging networks. The charger uses the flame-retardant EMS-Grivory LFT for the car charging station system, which is designed for rough daily use, while the Grilamid L grade is used in the charging system's active liquid cooled cable.

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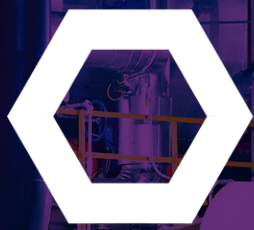
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IMAGE: SPEZIALPRODUKTE

Sustaining innovation in processing aids

Manufacturers of processing aids have added sustainability to the list of essential innovations. Peter Mapleston reports on some of the latest developments

In today's climate, sustainability is key when it comes to processing aids and lubricants for plastics compounds. These additives have long been used to facilitate compounding and final product processing but now producers are increasingly looking to "green" sourcing and supply chains. Functionality remains important, of course, and suppliers are also paying particular attention to process economics.

A prime example of the sustainability trend can be seen at **Clariant**. At the K show last year it announced that it had teamed up with Neste – the Finnish company that began as an oil producer but is now a leading player in the shift to renewable resources – to offer a wide range of additives based on mass balance-certified ethylene and propylene from renewable hydrocarbons.

The renewable hydrocarbons come from raw materials such as waste and residue oils. Because they are chemically identical to current alternatives, the Clariant Terra additives are like-for-like drop-ins

– there is no need to retest, renew registrations or to modify production processes or equipment.

In addition to its Terra range, Clariant has also introduced the Vita range, nine rice bran wax-based solutions for formulators of high-performing engineering plastics, bioplastic compounds, masterbatches and coatings, based on non-food competing feedstock.

Frank Neuber is North America Technical Manager in the Advanced Surface Solutions section of Clariant's Additives Business Unit. He sees sustainability as one of the main influences driving new developments in processing aids and lubricants.

"Sustainability has become one of the main topics of interest for most of our clients. Many major clients have even created new positions for Managers of Sustainability, usually with a VP or Director title. Clariant's non-food-competing and sustainable products, such as Licocene Terra and Licocare RBW Vita, have been met with enthusiasm by these companies," he says. ➤

Main image: Processing aids such as waxes are essential in polymer processing. Latest developments focus on improving performance and sustainability



IMAGE: NESTE

Above:
Clariant is using renewable feedstocks produced by Neste in its Terra product line

Performance goals

However, it is not all about sustainability. With pigment and manufacturing costs continuing to climb, Neuber says adoption of novel processing aids and lubricants that improve dispersion - resulting in reduced loadings of costly pigments and increased production rates - will continue to grow. "We can also see an increasing demand for solutions that provide excellent heat and colour stability even when used in aggressive processing conditions of high temperature engineering polymers," he says. Neuber says improving pigment dispersion is the first target of many Clariant customers. "When they can improve an FPV [Filter Pressure Value] result of a difficult-to-disperse pigment from, say, 6 to 2 [bars pressure rise/gram pigment], it opens the door to film and fibre applications, while also allowing a reduction in the dosage of a costly pigments needed to achieve the target colour and chroma," he explains.

"An added benefit of the faster production is the reduced need to change extruder screens, while enjoying more consistent and reduced extruder pressure profiles. These two effects reduce the overall cost of materials and production, while delivering higher quality products, which means better physical integrity of the finished articles," he says.

High heat stability - which in this case means resistance to discoloration and volatilisation - and a clean initial colour are also needed to allow quick colour matches that stay consistent over long, aggressive extruder runs at the masterbatcher or compounder, Neuber adds. "These requirements are also needed at their clients' facilities, when they use high temperatures and elevated barrel pressures to assure complete distribution of masterbatches into their polymers and the fastest production rate possible."

Performance is critical. "Lubricants and dispersants must not discolour, degrade or volatilise during the production of final articles that have to pass industry tests on such things as volatility [for automotive interiors] and still maintain a blemish-free surface with the desired gloss or finish," Neuber explains.

The Licocare RBW Vita range, which is a follow-up to the Licocare RBW range introduced by the company two years ago, is intended for use with engineering polymers and polyolefins. It gained Clariant a Gold level Material Health Certificate from the Cradle to Cradle Products Innovation

Right:
Clariant's Licocare RBW waxes are produced from rice bran and are pitched as montan ester wax alternatives

Institute. "It fully supports the market requirement for additives that go beyond current sustainability requirements, without compromising on the high-performance requirements in customer applications," says Neuber.

Bio-based waxes

Licocare RBW Vita waxes were originally developed to match or improve the performance of Clariant's long-standing montan ester waxes, which are derived from brown coal. They are based on the same structures and made in the same reactors as montan waxes. Clariant says the bio-based raw materials are cleaner, however, which Neuber says means that analogous structures are brighter and perform equal to, or better than, the incumbent montan ester waxes.

"Clariant has performed dozens of comparative tests such as melt flow, mould release, dispersion and colour development to support the positive properties and superior colour [less yellow] of products made with the new RBW's in a variety of polymers, including polyamides, polyesters, PC/ABS, and PLA," he says. "Our Licocare 360 Vita TP even speeds up the cycle time when injection moulding polyamides, due to its nucleation effect on the PA. It causes the polymer to crystallise more rapidly, which reduces the cooling time of the injection moulding cycle and also reduces shrinkage and warpage, problems often encountered when using troublesome pigments and long cooling times."

The Licocene Terra range is a renewable feedstock version of Clariant's existing Licocene range, which includes two waxes for plastic processing as well as for LPP performance polymers used as hot melt adhesives. Licocene PE 4201 Terra is a lubricant for polyolefins and a nucleating agent for EPS; Licocene PP 6102 Terra is an external lubricant for PVC extrusion and a dispersing agent for



IMAGE: SHUTTERSTOCK



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IMAGE: VÖLPKER



Above: Völpker produces a broad range of wax processing aids

pigments and additives in masterbatches. Clariant is moving ahead on more developments. "Additional work on compatibilisation needs to be done to further the efforts towards realising a circular economy, via re-use and recycling of often impure materials," says Neuber. "Functional waxes and polymers can certainly help this area. Also, more nucleation development with lubricating and processing aids can surely help reduce energy consumption and make for better quality finished goods for work, home and transportation."

System performance

Montan wax producer **Völpker Spezialprodukte** markets its products as Waradur and Cevo, which is a more recent introduction. Its main development emphasis is on improving sustainability through improved system performance of its products, but it is also working on bio-based grades.

Looking first at the performance work, Business Development Leader Dr Lutz Matthies says the company recently carried out investigations into how these products can affect the distribution of carbon fibres in polypropylene. It has also shown that significantly reduced cycle times can be achieved in injection moulding of PA66.

Matthies says use of one of its waxes, Waradur E (an ester wax consisting of montanic acids with ethylene glycol), enabled a compounder of carbon fibre-reinforced polypropylene compounds for electrical and electronic applications

to reduce expenditure on raw materials. When using 0.5% Waradur E in a compound containing 8% carbon fibre, a reduction in electrical resistance (ohm) and specific electrical resistance (ohm·mm²/m) in the range of two orders of magnitude was measured (Table 1).

"Waradur E causes a very good distribution and alignment of the individual fibres, so that the conductivity is significantly improved, which manifests itself in a drop in resistance values," says Matthies. "This significantly-improved carbon fibre distribution ultimately leads to a reduction in the cost of raw materials, for example up to 50% less carbon fibre usage with about the same conductivity."

In investigations into the protection and distribution of flame retardants in compounds, Völpker was able to overcome a problem for a compounder of a glass reinforced FR grade of PA66 that was unable to efficiently mould the compound without strong foaming. The FR additive was being partially degraded as a result of the high shear forces that occurred during processing, with the acid that was produced initiating degradation of the polyamide resin.

"The use of Waradur OP (0.3%) instead of calcium stearate reduced the shear stress of the melt to such an extent that foaming did not occur," says Matthies. "The compound could be produced without problems while maintaining the required fire classification V0 (UL94)." Waradur OP consists of esters of montanic acids with multi-hydroxyl alcohols; it also contains calcium montanate.

Specialised solutions

Völpker's Cevo waxes enable the innovation potential of specialised waxes to be fully exploited, according to Matthies. "Cevo additives can be used to solve processing and application-related issues," he says. He highlights aspects such as material distribution, fast injection, filling long flow paths, the avoidance of friction peaks, fast demoulding, and process stabilisation of the compound.

"These wax additives perform very specific tasks," Matthies says. He cites the example of a compounder that was using re-milled and agglom-

Table 1: Data showing a significant reduction of electrical resistance in carbon fibre reinforced PP through the use of Waradur E and OP montan waxes as dispersing agents

	PP +8.0 % carbon fibre	PP + 8.0% CF + 0.5% Waradur E	PP + 8.0% CF + 0.5% Waradur OP
Electrical resistance [Ω]	2.5 x 10 ⁴	4.5 x 10 ²	4.2 x 10 ²
Specific electrical resistance [Ω mm ² /m]	1.2 x 10 ⁷	2.0 x 10 ⁵	2.0 x 10 ⁵

Source: Völpker Spezialprodukte

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IMAGE: EMERY OLEOCHEMICALS



Above: Emery's Loxiol external lubricants for PVC processing are bio-based

erate-based polyamide for the production of polyamide compounds that was unable to improve and stabilise product quality.

"The quality of such polyamide compounds is normally more volatile than that of virgin polymer-based compounds. The reasons for this are primarily the degradation induced in polyamides initiated by thermal preloads and processing-related inhomogeneities of the recycled material," he explains. "The use of Cevo-process A-3110 enabled the production of compounds with low variation in mechanical characteristics and consistent processing properties." The A-3110 additive is described as a special one-pack including a synergistic combination of different lubricating

agents as well as a balanced mixture of stabilisers.

Another compounder producing glass fibre reinforced and impact modified polyamide compounds was able to improve its product's mould filling by 45% (spiral flow test) using 0.5% of Cevo-process A-3100 instead of zinc stearate. The additive is said to have further improved the surface quality of the injection moulded parts produced. A-3100 includes a synergistic combination of different lubricating, release and dispersing agents.

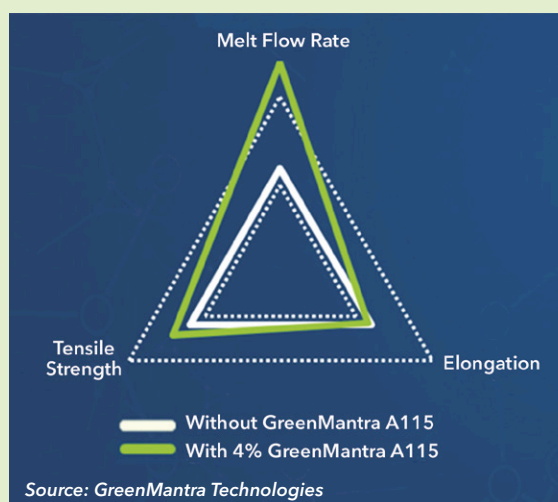
In a third case, a microtalc-filled PA6 compound showed ineffective processing behaviour in injection moulding. The customer replaced the wax additive it had been using with 0.5% Cevo-process J-4418 (which is based on renewable plant waxes). "The flow behaviour was improved by 15% and both ejection force and the cycle time were reduced by more than 40%," says Matthies. Cevo-process J-4418 contains modified natural long-chain fatty acids (mainly C19 - C32).

Polish company **Euroceras** has been making synthetic waxes for more than 45 years. It has reactors for production of polyolefin waxes as well as polar copolymer waxes and what it describes as "unique polyester waxes". The main plastics application areas for the Ceralene-branded waxes are for dispersion in colour and additive masterbatches, external and internal lubrication in PVC processing, as well as flow improvement in techni-

Greener option for recycled compounds

Canada's GreenMantra Technologies says it has successfully scaled its thermo-catalytic depolymerisation recycling technology to create specialty polymers and synthetic waxes from waste polymers such as PE, PP and PS.

The company recently released application data showing how compounders and converters can use these materials as processing aids to increase recycled content in compounds. It says a key contributor to the low use of post-consumer recycle (PCR) is the difficulty processors have incorporating higher levels (>25%) into end products. It says this is primarily due to the variability of properties in recycled plastic streams.



Typical effect of GreenMantra A115 on properties of a PE compound containing 25% post-consumer recycle. MFI is increased while elongation is maintained and tensile strength improved

"Compounders and converters typically use GreenMantra's [processing aid] at a level of 1% to 4% – this in and of itself counts as recycled plastic," says Sapp. "On top of that, the material gives companies a

GreenMantra Global Market Development Director Christy Sapp says its new data demonstrates how additives such as its A115 product allow manufacturers to overcome some of these processing, compatibility, and quality challenges.

'multiplier effect', allowing them to incorporate additional recycled content (or lower quality streams with higher MFI) at levels of up to 50% without losing output or impacting final performance properties."

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cal plastics and fibre filled compounds. For applications in polar plastics Euroceras offers PE/MAA-copolymer waxes and synthetic polyester waxes, which it says have properties similar to those of montan waxes.

Pitched for PVC

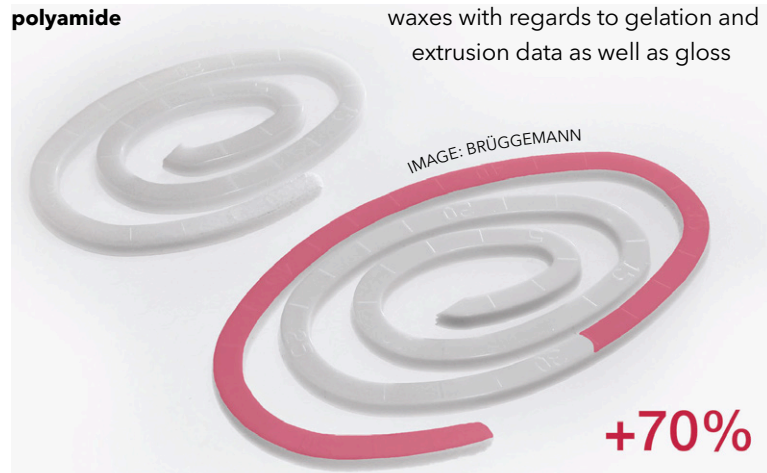
It is close to 10 years since the European PVC industry made a voluntary commitment to move towards more sustainable additive systems and to aim to switch to renewable sources. "In that respect, the European PVC industry is committed to use bio-based additives whenever they provide at least the same performance level as conventional, fossil-based additives," says speciality chemicals producer **Emery Oleochemicals**.

Emery's Green Polymer Additives (GPA) business unit develops high-performance polymer additives including a wide range of lubricants particularly suitable for PVC applications. Most of these additives, branded Loxiol, are produced from bio-based materials.

The company says that external lubricants for PVC help reduce mechanical impact and shear rate of extruder screws and calender rolls, leading to an extension of gelation time. Since external lubricants need to migrate to the surface of the PVC during processing, they need to be only minimally compatible with the PVC matrix. As PVC is a quite polar polymer, non-polar additives such as paraffin waxes and polyethylene waxes typically work well as external lubricants. But they are not the only options, says Dr Christian Müller, Global Technical Market Manager in Emery's GPA BU.

"It may be surprising to learn that ester waxes can also be external PVC lubricants although they have polar ester functions, and potentially additional polar functions, in their molecule," says Müller. He explains that in a recent belt extrusion study, external ester waxes showed very similar or the same performance characteristics as hydrocarbon waxes with regards to gelation and extrusion data as well as gloss

Below:
Bruggolen TP-P180 has a substantial effect on flow in semi-aromatic polyamide



and static thermal stability of the extruded belts.

"External ester waxes also demonstrated benefits when it comes to the additive's volatility. The lower the additive volatility, the lower the loss during processing to the degassing unit and the lower the risk some deposits will form due to condensation at the die or in the calibre," he says. "Conventional hydrocarbon wax lubricants can be replaced by tailored ester lubricants with high bio-based content to provide effective external lubrication."

PA flow enhancement

Away from waxes, what is claimed to be the first flow enhancer for semi-aromatic polyamides was introduced by **Brüggemann** at last year's K exhibition. This product joins Bruggolen TP-P1507, which is already widely used for aliphatic polyamides such as PA6, PA66 and PA12. The company says that both additives demonstrate very significant improvement in melt flow while retaining the mechanical properties of finished components. Supplied in pellet form, they are said to be easy to dose and disperse during direct injection moulding and compounding.

Trials carried out with independent testing laboratory RJG Technologies showed that Bruggolen TP-P1810 enabled an in excess of 20% cycle time reduction during moulding and, significantly, allowed filled compounds containing 50% and more of glass fibre to be injection moulded into intricate and complex shapes. For instance, during moulding tests, the flow spiral of a semi-aromatic polyamide reinforced with 50 wt% glass fibre was lengthened by 70% at a dosing rate of Bruggolen TP-P1810 of only 1.5%.

"Much-improved colour and appearance of the resultant moulded parts are a welcome result of the excellent processing enabled by Bruggolen TP-P1810," says Dr Klaus Bergmann, Head of Polymer Additives at Brüggemann. "Alternatively, by allowing a 30°C reduction in melt temperature, the additives clear the way to gentler processing and reduced energy consumption."

Bergmann says the products are different from anything else on the market, both in terms of their chemistry and efficiency. "They are not just a mixture of different lubricants, as some others are. The product form is polymeric granules."

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Making an impact

Whether for demanding automotive components or lightweight packaging items, many polymer applications call for improved impact performance. Mark Holmes examines developments

Plastics are noted for their durability, which is why they are used so successfully in such a wide variety of markets and applications. However, in-service performance can be limited by many physical attributes and impact resistance is high among them. Impact modification provides one solution, compensating for inherent brittleness, embrittlement at sub-zero temperatures, notch sensitivity or poor crack propagation characteristics. Typically, this is achieved by introduction of a secondary component that bonds mechanically or chemically with the primary polymer matrix and that acts to absorb or dissipate the energy of an impact.

Kraton supplies a variety of styrenic block copolymer modifiers that can deliver the improved toughness required to achieve lighter and more durable product solutions in polymers including PS and polyolefins. "Impact modification is an important pillar in plastics modification but two others are equally important: excellent processing and modulus retention. Kraton has developed a broad product portfolio that successfully responds to

these challenges," says Bob Hall, Kraton's Senior Director Global Marketing.

They also address cost challenges. "Our polymers are more efficient modifiers than polyolefin elastomers so they require lower dosing, which helps maintain modulus," Hall claims. "In composite structures, the lower dosing allows customers to increase the level of reinforcing ingredients. In addition, our high flow grades - such as Kraton MD1653 or Kraton MD1648 - enable savings by reducing cycle time or enabling higher compounding throughput." MD1653 is a developmental high flow SEBS grade suitable for food contact and medical applications.

Application of Kraton's modifiers is not restricted to commodity plastics. Its functionalised FG1901 grade, which has a PS content of 30%, improves impact properties and processability of semi-crystalline polyamide (PPA) and polyphenylsulphide (PPS).

Kraton says its impact modifiers can play a part in the development of sustainable "circular" compounds. "In the plastic recycling industry, our

**Main image:
Ever more
demanding
end-use
applications
call for plastic
compounds
with better
impact
performance**

Right: PP frozen food packaging benefits from Kraton's impact modifiers

polymers provide several benefits, such as increasing the amount of recycled content, improving the durability of products with recycled contents, and enabling the use of mixed or contaminated streams. These benefits are due to our polymers' ability to compatibilise different polymers," Hall says. "These advantages are highlighted in a study by the University of Ghent in Belgium, which demonstrated that processors can achieve recycle reusability in end of life cycles by up to five times."

Sustainability gains also extend into the automotive sector, where the ability to use lighter impact-modified parts reduces fuel consumption and cuts carbon dioxide emissions. "Big injection moulded automotive parts with complex designs - combined with thin walling and long flow lines - require special molecular architecture," says Hall. "Kraton MD1648 provides the desired impact strength while rendering process efficiency. With a melt flow rate of about 220 g/10min at 230°C, the polymer is the only hydrogenated styrene block copolymer (HSBC) on the market to deliver this solution."

MD1648 is an addition to Kraton's enhanced rubber segment series with a melt flow rate said to be 10 times higher than its next nearest competitor, which also makes it suitable for production of highly filled masterbatches.

Low temperatures

Frozen food packaging requires ultra-low temperature impact strength. Kraton G1657 VS is a clear copolymer with a polystyrene content of 13% supplied in powder form. It is used in the manufacture of PP ice cream tub lids. The polymer enables PP compounds to survive processing, storing and transportation at temperatures as low as -40°C and enables some 13% weight reduction and 7% material savings compared to plastomer solutions, according to the company.

The latest addition to **Milliken's** DeltaMax Performance Modifiers range is designed to expand the use of the additive into markets such as food packaging. The company says the technology allows injection moulders to make stronger parts using more efficient manufacturing

parameters and to source a broader range of raw materials.

The new additive, DeltaMax 5000A, is expected to drive polypropylene (PP) innovation at the resin producer level in particular. "DeltaMax 5000A will allow resin producers to expand the performances of their resin portfolios and to boost their productivity by increasing the throughput of their



IMAGE: KRATON

reactors," says Herrin Hood, Milliken Global Marketing Director.

The company says polypropylene moulding products typically require high melt flow and excellent impact resistance while maintaining good stiffness. However, it says tweaking the material for one property has always meant sacrificing another one of those properties. Milliken claims that DeltaMax Performance Modifiers can raise melt flow while optimising impact properties.

By maximising the impact strength and melt flow of resins without compromising stiffness performance, processors using DeltaMax-modified resins can use PP in a wider range of applications in more cost-effective ways. Running high-melt-flow resins allows converters to be more productive and make more complex parts, while also improving their carbon footprint by reducing scrap and using less energy in the moulding process.

In addition, the DeltaMax technology is said to be effective in modifying post-consumer and post-industrial recycled resins. It is claimed to elevate impact and melt flow to levels associated with virgin resins, which allows compounders and converters to incorporate up to 100% recycled PP without sacrificing performance or processing. With FDA approvals expected by year end, Milliken's new performance modifier will expand usage of the product into some food packaging applications, driving benefits for caps, closures and thin-wall packaging. The company is currently pursuing food approvals for Europe as well, with approvals expected in late 2020.

Easing recyclability

One company already exploiting the Milliken technology is US-based plastics recycler **Aaron Industries**. Its JET- FLO Polypro is a high melt flow recycled PP compound featuring DeltaMax Performance Modifier and that combines an extremely high melt flow index (MFI of 50-70 g/10 min) with good impact performance (notched Izod of 1.5-2.0). According to the company, this combi-

Below: Milliken sees its latest DeltaMax additive appealing to PP polymer producers



IMAGE: MILLIKEN



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Right: JET- FLO Polypro high melt flow recycled PP from Aaron Industries uses Milliken's DeltaMax Performance Modifier

nation of high MFI and good impact strength makes JET-FLO Polypro a good choice for durable thin-wall parts such as housewares.

By adding significant value to recycled PP, Aaron Industries aims to encourage broader use of sustainable alternatives to virgin PP resin. "Our new JET-FLO PP is a major step forward toward expanding the use of recycled plastics," says Robert M Tocci, Vice President of Aaron Industries. "Manufacturers no longer have to sacrifice impact performance to achieve the high melt flow, which is essential for thin-wall moulding and faster throughput. Our collaboration with Milliken to leverage DeltaMax technology has been a great success. Milliken is one of the few suppliers with the knowledge, enthusiasm and technical resources we needed to help us develop this new compound and drive true innovation in the recycling industry."

Historically, Aaron Industries used peroxide to increase the MFI of its recycled PP. However, the peroxide route also reduces impact strength. The DeltaMax technology enables recycled PP to deliver equal or better performance and processability compared to virgin resins, increasing MFI by as much as five times while maintaining impact strength.

Aaron Industries and Milliken finalised the development of the JET-FLO compound in seven months. The product, which is available in eastern parts of the US and Canada, is supplied as pellets in black and grey. The companies say that although many manufacturers want to incorporate recycled PP into their applications to increase sustainability and reduce costs, they face challenges in sourcing materials with the needed properties. This is



IMAGE: MILLIKEN

particularly true when moulding thin-wall parts requiring good impact resistance. A key issue facing recyclers is the large proportion of recycled content that comes from single-use applications such as packaging. These material streams may lack the more-robust physical properties required for typical recycled PP applications such as durable goods. Recyclers also have to contend with variability in feedstocks.

Capacity expansion

Mitsui Chemical is currently expanding capacity for its Tafmer high performance polyolefin elastomers at its plant in Singapore. Available in several grades, the resins are suitable for a range of compound applications, with two grades developed specifically for use as impact modifiers. Tafmer PN is a propylene-based grade that features what the company describes as a controlled nano-crystalline structure. It is said to offer good impact modification in PP resins. Tafmer M is an acid-modified type suitable for low cost impact modification of polyamides.

Clariant Masterbatches and its Packaging Market group have developed a number of additive masterbatches to ensure that plastic packaging is recycled, including impact modifiers. Its CESA-mod additive masterbatches reduce brittleness and increase impact strength enough to allow bottles and containers made of post-consumer recycle (PCR) to better meet top-load and drop-test standards.

"We can recover - we must recover - much, much greater volumes and turn the vast amount of packaging waste into new raw material. To do that, we need to overcome major challenges around the capabilities of proper sorting of waste to produce a high-quality PCR and around issues related to colouration, stabilisation, product safety and process stability," says Alessandro Dulli, Clariant Masterbatches Global Head of Packaging.

High-heat solutions

Turning to some of the impact modified compounds on the market, **SABIC** recently introduced its Xenoy HTX resin, which uses a polyester-based high-heat technology for impact resistant, high performing structural automotive applications. The company says that Xenoy HTX resin is especially relevant for

Right: Additive masterbatches from Clariant are being used to improve impact performance of post-consumer recycle



IMAGE: CLARIANT MASTERBATCHES

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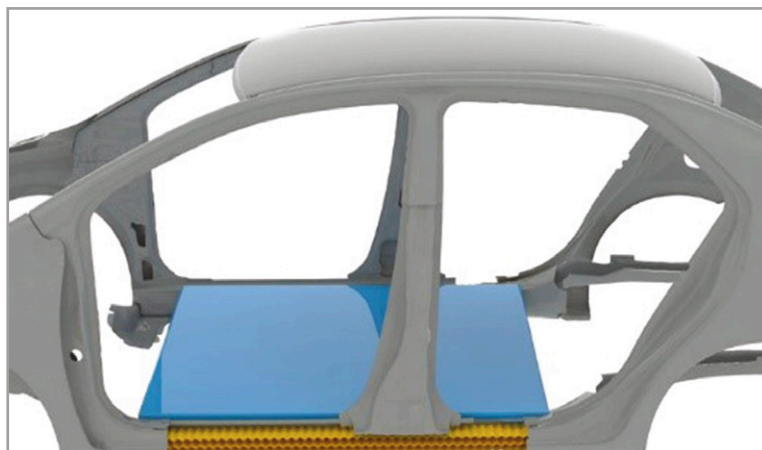


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SABIC is targeting its impact modified XENYO HTX resin at lightweight metal replacement for side rockers and battery module protection
Image: SABIC

today's automakers, which need polymer solutions for production of structural components capable of withstanding e-coating lines operating above 180°C. Applications include body-in-white components, structural reinforcements and battery protection systems for electric vehicles.

Xenoy HTX resin is available in unfilled and glass-filled grades and offers significant weight

savings compared to steel and aluminium. The first products in the line include unfilled Xenoy HTX 950 as well as two glass fibre reinforced grades, Xenoy HTX 975 and Xenoy HTX 575. The unfilled resin is modified to absorb significant energy and withstand plastic deformation in the event of a crash. SABIC is targeting the material for use as a lightweight metal replacement solution in new safety applications, including side rockers designed to offer protection for battery modules mounted to the floor of electric vehicles.

Lanxess has developed new polyamides for thermal management of devices, which are impact resistant, thermally conductive and easy to process. They are also claimed to offer good strain characteristics, improved flow and reduced tool wear. The new additions to the Durethan TC (Thermally Conductive) range are Durethan BTC67ZH3.0EF and Durethan BTC77ZH3.0EF.

"Both plastics are characterised by their significantly higher impact resistance and greater strain capability in tensile and bending tests than the other materials in our TC product range," says Dr Elisabeth Gau, Durethan product development expert at Lanxess. "This makes them ideal for

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components that require high impact resistance or feature fasteners such as snap fits.” Potential applications include connectors with snap fits, heat sinks, heat exchangers and mounting plates for electronic components.

The new compounds are filled with 67-77 wt% of an inorganic functional high thermal conductivity filler. Thermal conductivity is said to be near isotropic - virtually the same in all directions. In the direction of flow, this is 1.1 or 1.8 W/m K (Nanoflash process). Both materials are optimised with regard to flow and, as demonstrated in tests conducted in the Lanxess technical centre, are also less abrasive and gentler on tools during processing.

In addition to toughness (in its conditioned state, for example, Durethan BTC67ZH3.0EF is around five times more impact-resistant than the company’s existing Durethan BTC65H3.0EF grade), the materials also feature other good mechanical properties. The elongation at break of Durethan BTC77ZH3.0EF in its conditioned state, for example, is more than double that of the previous Durethan BTC75H3.0EF, which is filled with 75 wt% of thermally conductive mineral. This means the material can absorb more energy during deformation, which in turn prevents the component from breaking so quickly under load.

Phase inverted TPO

Using its Catalloy process, **LyondellBasell** has developed a “phase inverted” structure in its Hiflex TPO resins where the elastomer acts as the matrix and the polypropylene (PP) as the modifier for improved impact resistance. Hiflex TPO resins combine the properties of existing Hifax and Adflex

TPO resins, including easy processing, recyclability, flexibility, weatherability, weight reduction, high thermal resistance and low gloss together with improved impact, stiffness and shrinkage performance balance when used in a compound.

According to the company, Hiflex TPO resins enable customers to meet challenging requirements on performance, recyclability and processability as they offer an alternative to high-priced flexible polymers, engineering resins or metallocene polyolefin elastomers (for example, C₂C₄ or C₂C₈). Hiflex TPO resins can be used directly or as a building block in compounds for a wide variety of applications.

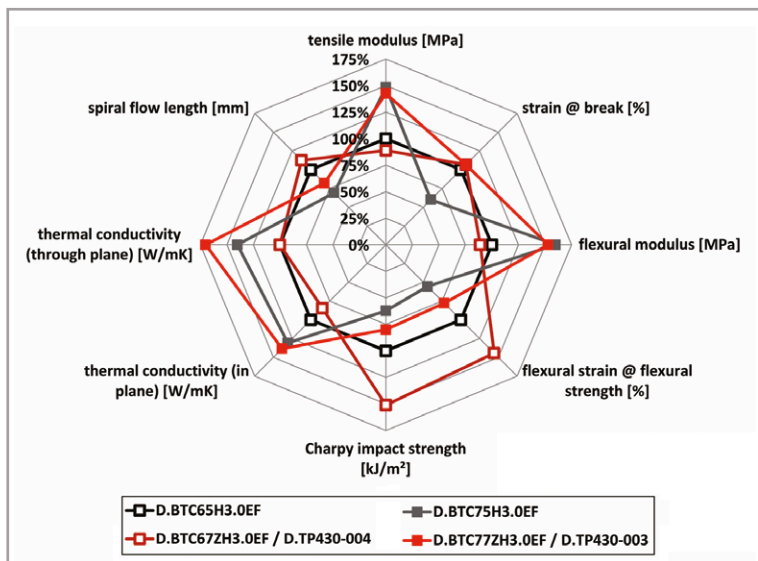
In particular, Hiflex CA7600A is optimised for polymer modification applications, providing good compatibility with other polyolefins and a variety of other thermoplastics. It can be used as an impact modifier but can also enhance stiffness and adjust shrinkage, according to the company. It is supplied in a granule form and is said to flow well in materials handling systems and hopper feeders at typical ambient plant temperatures.

LyondellBasell adds that its TPO resins provide improved impact at low temperature. Unlike conventional TPOs that are mechanical blends of elastomers or plastomers in a polypropylene matrix, it says that its TPO is an alloy of rubber and polypropylene produced simultaneously in the polymerisation reactor. It claims this creates a better dispersion of the rubber in the material, which has a direct effect on the processing consistency and end-use properties.

Compared to elastomers or plastomers, the Catalloy family of TPO resins - which includes the Hifax, Adflex and Softell lines - do not necessarily require additional off-line blending with polypropylene. It says this minimises complexity and manages the risk of inconsistencies in blends. Catalloy TPO technology is also claimed to enable control of key properties such as: stiffness and impact balance; low specific gravity; thermal resistance; low-temperature flexibility; optical properties; dimensional stability; softness; compatibility with polyolefins; and ease of processing

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Performance characteristics of the latest thermally conductive Durethan PA compounds from Lanxess, compared to previous grades

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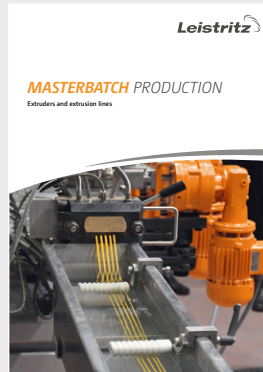
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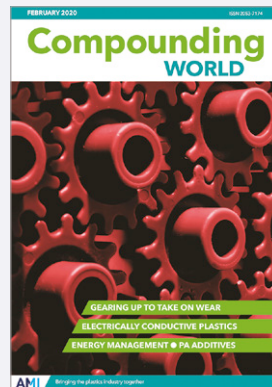
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Compounding World March 2020

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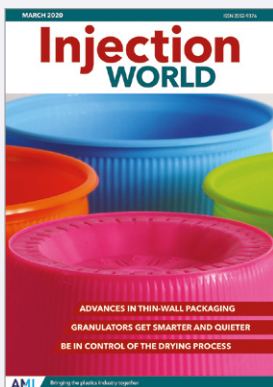
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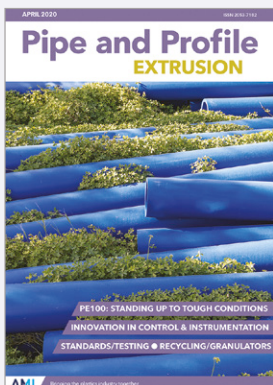
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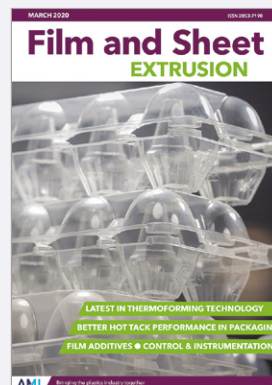
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	24-27 June	Interplas Thailand, Bangkok, Thailand	www.interplasthailand.com
	3-6 August	Chinaplas, Shanghai, China NEW DATE	www.chinaplasonline.com
	8-10 September	Feiplar, Sao Paulo, Brazil	www.feiplar.com.br
	9-13 September	Taipei Plas, Tapei, Taiwan	www.taipeiplas.com.tw
	10-12 September	Plasti & Pack, Lahore, Pakistan	https://plastipacpakistan.com
	21-25 September	Colombiaplast, Bogota, Colombia	www.colombiaplast.org
	29 Sep-1 Oct	Interplas, Birmingham, UK	www.interplasuk.com
	6-10 October	IPF Japan, Tokyo, Japan	www.ipfjapan.jp
	7-8 October	Compounding World Expo Europe, Essen, Germany NEW DATE	www.compoundingworldexpo.com/eu/
	13-17 October	Fakuma, Friedrichshafen, Germany	www.fakuma-messe.de
	4-5 November	Compounding World Expo USA, Cleveland, USA	www.compoundingworldexpo.com/na/
	8-11 November	Pack Expo, Chicago, USA	www.packexpointernational.com
	10-13 November	Plastimagen, Mexico City	www.plastimagen.com.mx
23-26 November	All4Pack, Paris, France	www.all4pack.com	
1-5 December	Equiplast, Barcelona, Spain NEW DATE	www.equiplast.com	
2021	13-16 April	Chinaplas 2021, Shenzhen, China	www.chinaplasonline.com
	4-7 May	Plast 2021, Milan, Italy	www.plastonline.org/en
	17-21 May	NPE 2021	www.npe.org

AMI CONFERENCES

14-16 September	Polymer Sourcing & Distribution, Hamburg, Germany
16-17 September	Polymers in Flooring North America, Atlanta, GA, USA
16-17 September	Plastics Recycling Technology Europe, Vienna, Austria
16-17 September	PVC Formulation Asia, Bangkok, Thailand
30 Sept-1 October	Performance Polyamides Europe, Dusseldorf, Germany
12-14 October	Polyolefin Additives Europe, Cologne, Germany
20-21 October	Oil & Gas Non-Metallics Europe, London, UK
27-28 October	Plastic Pipes in Infrastructure Europe, Hamburg, Germany

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

PLASTICS RECYCLING
WORLD EXPO

POLYMER TESTING
WORLD EXPO

7 - 8 October, 2020
ESSEN, GERMANY

PLASTICS EXTRUSION
WORLD EXPO

COMPOUNDING
WORLD EXPO

4 - 5 November, 2020
CLEVELAND, OHIO

www.ami.international/exhibitions



THE LATEST EXTRUDING NEWS FROM ENTEK

BiOREGION
TECHNOLOGY

CHOOSES

**ENTEK**

Innovative Start-up Using ENTEK for Production of 100% Natural Additives for Plastics



The bioplastics industry continues to grow, as new and innovative natural additives and materials are continually being brought to market. As a pioneer in bioplastics production, ENTEK has worked with customers since the 1990's to develop and refine new biodegradable and bio-based formulations for use in a wide variety of applications.

This work continues today and has become more important than ever, as the plastics industry responds to challenges to make products that are more environmentally friendly. With the bioplastics market predicted to grow as much as 25% over the next five years, it also makes good business sense for material suppliers and compounders to explore this market.

New Applications for Agricultural By-Products Show Great Promise

A new entry in the bioplastics market is BioRegion Technology (BRT). This Pacific Northwest start-up has developed an innovative way to process agricultural by-products for use as additives for a variety

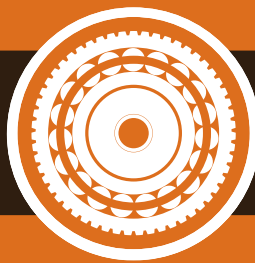
of plastics part applications. The material is proprietary, but early results show that these 100% natural and biodegradable materials have great promise as additives for packaging, housewares, and numerous other plastic part applications.

Phil Brunner, Vice President of Product Development at BRT, had a history of working with ENTEK as he previously worked at Interfacial Consultants (IFC) of Prescott, WI (IFC was recently acquired by Nagase Holdings America). "I had a lot of experience with ENTEK so when I moved to the Northwest to start work on this new venture, they were one of the first companies I called," he said. "They have always been great to work with on new materials development and their technical support is outstanding."

BRT works with ENTEK directly in Oregon and runs lab trials on materials. For production runs, they use IFC. "IFC is set up with ENTEK machinery and they do a great job for us," said Dave Dowling, General Manager of BRT. "They've been instrumental in helping us refine our process and bringing our products to market."

(continues on page 3)





Open for Business

Welcome to the latest issue of *Extrusion Solutions*.



Larry Keith

“ ENTEK doesn't do things halfway, and it's no different with this crisis. We are leading the state with the precautions that have been taken to both protect our employees, and to keep our operations up and running. ”

To Our Customers: ENTEK is Here for You

A lot has changed in the world over the past couple of months. Despite the outbreak of the COVID-19 crisis and its global implications, I want you to know that ENTEK remains open for business. We have been given “Essential Manufacturing” status by the State of Oregon and we are going to be open and available to support you during this difficult time.

Those of you who know us know that ENTEK doesn't do things halfway, and it's no different with this crisis. We are leading the state with the precautions that have been taken to both protect our employees, and to keep our operations up and running. Some highlights include:

- 2' plexiglass extensions of all employee cubicles for social distancing protection,
- Limiting visitors on campus to essential personnel,
- Cleaning kits in every conference room for before and after meeting cleanings,
- Installation of hand sanitizer stations at all doors,
- Working from home for those that can,
- Alternating shifts of personnel who need to be in the office to help social distancing

We realize these are challenging times for you and we want to support you as best as we can. Contact us anytime.

Bioplastics Development

It seems like just yesterday we were working with one of the pioneers in bioplastics development, Plantic Ltd., to help them develop their materials for biodegradable packaging. That was actually over 15 years ago and since then, we have worked with a lot of other companies in the bioplastics space to help them compound a wide variety of materials.

Our latest success story is featured on page 1 of this issue. BioRegion Technology is an Oregon company that is working on some very exciting 100% natural, biodegradable additives for plastics. Their first product, Renew™ cellulose, is already being used commercially, and we are working with them on some other proprietary products. Those products have the potential to be game-changers in the plastics industry. We will keep you posted. In the meantime, if you have an idea for a new bio-based product, let us know. We can help you run trials here at our plant in Oregon, or visit your facility as well.

Gearbox Rebuilds, Customer Service and More

In this issue you will also find stories on our gearbox repair services, our latest customer support department news, and more.

It came to our attention recently that some customers didn't know they could send their ENTEK gearboxes to us for repairs. Please be assured that we provide this service, and if you are ever in doubt about what services we provide, contact us. We pride ourselves on supporting our customers any way we can, and that means helping you get the most out of your ENTEK machinery and equipment.

Thank you to all of our customers for your continued support. Please stay safe and we wish you good health – if we all do our part this COVID-19 crisis will soon pass.

I encourage you to contact me anytime at lkeith@entek.com.

Sincerely,

Larry Keith
CEO, ENTEK





BioRegion Technology Chooses ENTEK

(continued from page 1)

Success with Renew™ Cellulose

BRT's first product is already seeing great results. BRT's Renew™ cellulose was developed as a drop-in replacement for other commercially available cellulose products. BRT currently has extensive capacity for Renew™ and that's growing, according to Dave Dowling.

"We have great confidence in this product," said Dowling. "We have ample infrastructure and feedstock for Renew and it is showing excellent results as a reinforcement agent for plastic parts."

In addition to being 100% natural and biodegradable, Renew provides numerous advantages including excellent dispersion of cellulose fibers in the plastic part, which are often hard to disentangle, according to Brunner. Benefits include lightweighting and reinforcement properties.

BRT is nearing commercialization on several consumer items including a product molded out of PP that uses 20% Renew cellulose, designed for pets. Marketed as a biocomposite product that utilizes renewable materials, this

product has been successfully molded by Taylor Made of Hartland, WI. Other applications for Renew include automotive parts, eating utensils, and more.

Future BioRegion Technology Products in Development

BRT has a number of new products in development. While they can't disclose specifics at this time, they are working on new additives that they refer to as 'biocarbon' that are still in test mode. "We are not ready to promote these yet, but we are excited about the potential of these products," said Brunner. "They could be game-changing for the plastics industry."

One thing BRT is happy to disclose is their close working relationship with ENTEK. "Our business is growing," said Dowling, "and as we continue to grow, I'm very confident we will be growing with ENTEK."

For further information on BioRegion Technology and its products, contact Dave Dowling at david.dowling@bioregiontech.com or Phil Brunner at phil.brunner@bioregiontech.com.



Customer Support News

By Darla Bulmer, Customer Support Manager



Darla Bulmer

2020 FOCUS: Customer Support Team Preventative Maintenance Program (PMP)

PMP Plans are the 2020 focus for our Customer Support Team, our goals are to:

- Prevent Failures, Wear And Downtime
- Extend The Lifecycle Of Our ENTEK Fleet
- Protect Our Customer's Investment

Developed with input from our customers and cross-functional technical teams, we launched our PMP Plan, which has been received with great enthusiasm and success!

Introducing our 2020 PMP PLAN

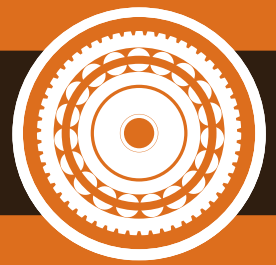
Customizable and complete, our plan targets the needs of each customer, we combine our complete **Mechanical Wellness Check** with additional **Critical Checks** – finding the best balance to ensure the comprehensive examinations will extend the life of your investment.

We are ready to help you avoid the stress and additional cost of unexpected failures and outages – many issues can be detected and avoided through regular checks of systems and equipment, along with checks for wear and obsolete parts.

To customize your own PMP Plan or for any questions, please contact our Customer Support Team at 541-259-1068 or ENTEK_Customer_Support@entek.com

The collage features three main components: a cover page for the '2020 PREVENTATIVE MAINTENANCE PROGRAM CUSTOMER REPORT' with the ENTEK logo; a 'MECHANICAL WELLNESS CHECKLIST' form with various inspection categories and checkboxes; and a line graph titled 'SCD Diameter (Inches) vs. Position' showing two data series over a range of positions.





ENTEK and the Recycling Market

It's no secret that the plastics industry is facing pressures to come up with solutions for dealing with the global solid waste crisis. Last October at the huge K2019 show in Germany, seemingly every exhibitor was promoting how their materials, products and services were contributing to a greener planet and to creating a truly circular economy.

This trend is good news for the plastics recycling industry, as more companies look for ways to process and recycle scrap plastic. Linda Campbell, ENTEK VP-Sales, says consumer goods companies and many others are looking to include recycled plastics in their products. "This green push means there is more demand for producing recycled materials, bio-based materials, etc. and that means there is more demand for ENTEK twin-screw extruders," she said.

Industry Growth Evident at the Plastics Recycling Conference

At the recent Plastics Recycling Conference held in Nashville from February 22-24, a show ENTEK has exhibited at for several years, the company saw increased interest in its twin-screw extruders. "We have supplied a lot of replacement wear parts to the recycling industry, including screws and barrels for their extruders," said Tammy Straw, Business Development Manager at ENTEK. "But now recyclers are talking with us about purchasing new twin-screw extruders. This market has traditionally used mostly single-screw extruders," she said.

"This year's Plastics Recycling Conference, for us, was the best one yet," she said. "This year there was real interest in twins whereas in previous years visitors would tell us that they aspired to one day use twins in their plant. We brought back a lot of solid leads from the show."

The increased interest in twin-screw machines is because recyclers are now being asked to not only increase output, but also to compound new and innovative formulations, a job that is perfectly suited for twin-screw extruders.

If you are a plastics recycler and need extrusion and compounding support, contact ENTEK today to discuss your application!

ENTEK WE ARE CIRCULAR

Hello Plastics Recyclers - ENTEK Has Your Twin-Screw Extruders!

Recycling is growing and recyclers need to up their game to meet industry challenges. **Contact ENTEK for help with your material compounding needs!**

200 Hansard Avenue, Lebanon, Oregon, USA, 97355
Tel: 541-259-1068 • entek.com

Twin-Screw Extruders | Replacement Wear Parts | In-House Pilot Plant Services
Complete Extrusion Systems | Turnkey Manufacturing Plants



Gearbox Rebuilds

Did you know?

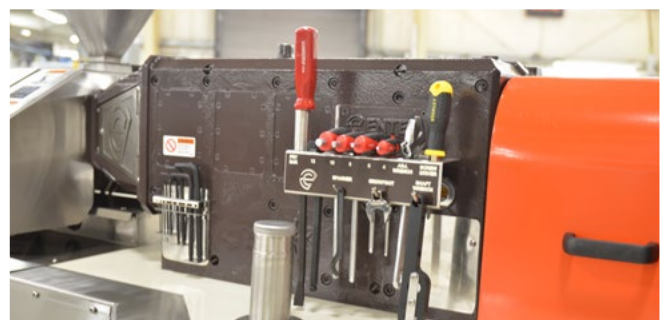
ENTEK rebuilds its gearboxes!

Our technicians are factory trained by our gearbox manufacturer, and we can rebuild any ENTEK gearbox for all of our twin-screw extruders, from 27mm through 133mm.

Here is the process for gearbox rebuilding:

- Must be sent to ENTEK for thorough inspection and cleaning
- A complete inspection report with photos is prepared by ENTEK technicians, along with a quote
- After receipt of order we rebuild/repair with OEM parts

We also offer rental gearboxes for a nominal charge to keep your line running while your gearbox is being repaired at ENTEK. Please check with us for a current list of gearboxes in stock.





Best Practices for Energy Management in a Compounding Plant

Editor's Note: for a recent story in Compounding World magazine, Dean Elliott, ENTEK's Technical Processing Manager, contributed the following information on ways compounders can save energy in a compounding plant.



Dean Elliott

ENTEK prescribes to lean manufacturing, and we see three forms of energy waste in compounding that can be avoided with proper planning and procedures.

Equipment Energy Loss

- It's important to spec the overall system correctly for your application. For example, if the extruder or downstream equipment is oversized or undersized, there is a potential for energy inefficiency (waste).
- Water cooled motors cool more efficiently than air cooled motors – already utilizing internal cooling system, whereas an air-cooled motor relies on an external blower for cooling.
- Running motors on VFD (variable frequency drive) increases efficiency (not running full speed when not necessary)
- Efficient cooling system that operates with latent heat of vaporization of water [barrels are internally cooled] blanket each barrel and shroud over blankets to help retain heat in barrel. Each barrel is individually temperature controlled.

Processing Energy Loss - Most of the energy generated is frictional heat which comes from the motor of the extruder. How do we minimize the use of that energy?

- Screw design – be sure not to overdesign the layout (screws should not be too aggressive). This is measured by SEI (specific energy input). For example, if a good quality product requires 0.100 (kW.hr)/kg, a screw design that uses 0.13 (kW.hr)/kg is overdesigned by 30% which is a waste of energy.
- Extruder operation –For example, running your screw speed too high with the screws too empty can increase your SEI unnecessarily like the example above. [measure by torque instead of speed to account for screw fullness]
- The co-rotating twin-screw extruder is an inefficient pump [roughly 10-15% efficient]. This equates to energy loss in restrictive areas such as mixing zones and at the die. Using the most ideal pumping elements will minimize your SEI/ reduce your wasted SE and increase your pump efficiency. When screws and barrels start to wear, the pumping efficiency is reduced. This can force the operator to run at higher screw speeds than necessary, or lower feed rates than desired.

- Using your HMI to trend processing under Industry 4.0 helps maintain optimal running conditions and rapidly take corrective action against upset conditions.
- Leaving the extruder powered on and/or the screws turning for long periods of time when not producing, there is wasted energy in the heating of the equipment. It also results in build-up of carbon which unnecessarily extends purging and clean out time and increases screw and barrel wear.
- Underutilizing equipment – could cause capital equipment expense unnecessarily. Understanding the limiting factors of your process and addressing them sometimes requires a design change on an existing piece of equipment in place of buying a whole new system. For example, less expensive options include: improving your screw design by breaking up short aggressive mixing zones into longer less aggressive zones; improving moisture removal from the process by adding a vacuum stuffer or a larger vacuum pump or vacuum pump filtration system; adding a melt pump as a more efficient pump; increasing the hole diameter on the die and/ or using a larger mesh screen size if quality allows.

Maintenance Energy Loss – Following best practice maintenance protocols can prevent waste in many areas.

- As mentioned above, wear of screws and barrels. It's advisable to learn and understand the amount of wear your process can tolerate. Replacing screws and/or barrels prematurely or after needed can lead to waste.
- Loss of a heater in a zone results in dependence upon frictional heat, which in turn effects your SEI.
- Cooling system – blocked valves allow water to pass through constantly, which causes more heat to be required than necessary to maintain the setpoint
- Heat control system – it's important to maintain a properly tuned heat/cooling system so that heating and cooling can be used efficiently. Large temperature oscillation is wasted energy.





We Are ENTEK



Our Latest Ad

Our ad campaign continues to grow! Just this month we have released the newest ENTEK ad featuring Melissa Jensen-Morgan, with information on our line of QC³ and HR³ twin-screw extruders.

We now have four ads in our current campaign. With a theme of 'Who We Are', 'Where We Are' and 'What We Do', our ads are designed to educate the industry on ENTEK's products and services. They also feature our people, who we believe are ENTEK's, and our customers', most valuable resource.

Watch for more ENTEK ads to come in the leading plastics industry trade publications!

ENTEK WHAT WE DO

Did You Know?

- ENTEK is the largest USA-based manufacturer of twin-screw extruders. All of our machinery is built at our headquarters in Lebanon, Oregon.
- We supply machinery for most compounding applications.
- All components are easily sourced and available.

ENTEK 400 Quick Change, Quick Clean, Quality Control. Features are available in about 1000 different sizes and are built to facilitate fast changeovers.

Our workhorse line of 400 High Rate, High Torque, High Reliability machines are built for continuous production and are available in sizes from 300mm to 1200mm.

Melissa Jensen-Morgan
Design Engineer, ENTEK Extruders

200 Hansard Avenue, Lebanon, Oregon, USA, 97355 • Tel: 541-259-1068 • www.entek.com

Upcoming Events

See ENTEK at the following upcoming events in 2020

**Extrusion 2020:
October 13 – 15**



Stephens Convention Center, Rosemont, IL

**Compounding
World Expo:
November 4 – 5**
Cleveland, OH



NEW FOR ENTEK

**Plastimagen:
November 2020**
Mexico City



**Plastics Recycling:
February 22 – 24, 2021**
Washington, DC



**NPE 2021
May 17 – 21, 2021**
Orlando, FL



<p>ENTEK WHO WE ARE</p> <p>Did You Know?</p> <ul style="list-style-type: none"> • ENTEK's Extruder Division celebrated 20 years in business in 2019. • ENTEK supports all of its customers - all of the time. Our programs provide the same level of service whether you are a start-up company or a large international corporation. • ENTEK is vertically integrated to ensure first class quality: the people who designed, built and tested our equipment each have and are available to support you at any time. <p>200 Hansard Avenue, Lebanon, Oregon, USA, 97355 • Tel: 541-259-1068 • www.entek.com</p>	<p>ENTEK WHERE WE ARE</p> <p>Did You Know?</p> <ul style="list-style-type: none"> • ENTEK has offices on both the east and west coasts of the USA to serve requests by its customers. • ENTEK has nearly 300 installations in 70 countries on four continents. • ENTEK answers the phone 24/7. No matter where you are in the world, you can speak to a real person anytime! <p>200 Hansard Avenue, Lebanon, Oregon, USA, 97355 • Tel: 541-259-1068 • www.entek.com</p>	<p>ENTEK WHAT WE DO</p> <p>Did You Know?</p> <ul style="list-style-type: none"> • ENTEK offers customized on-site operator training. • ENTEK is a leading source of Operator Safety, Troubleshooting, Commissioning and Maintenance, and Maintenance Training. • ENTEK systems, components and tools are selling, and can provide it at our Plant floor or at your facility. <p>200 Hansard Avenue, Lebanon, Oregon, USA, 97355 • Tel: 541-259-1068 • www.entek.com</p>
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RAISING EXPECTATIONS. KEEPING THEM THERE.

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