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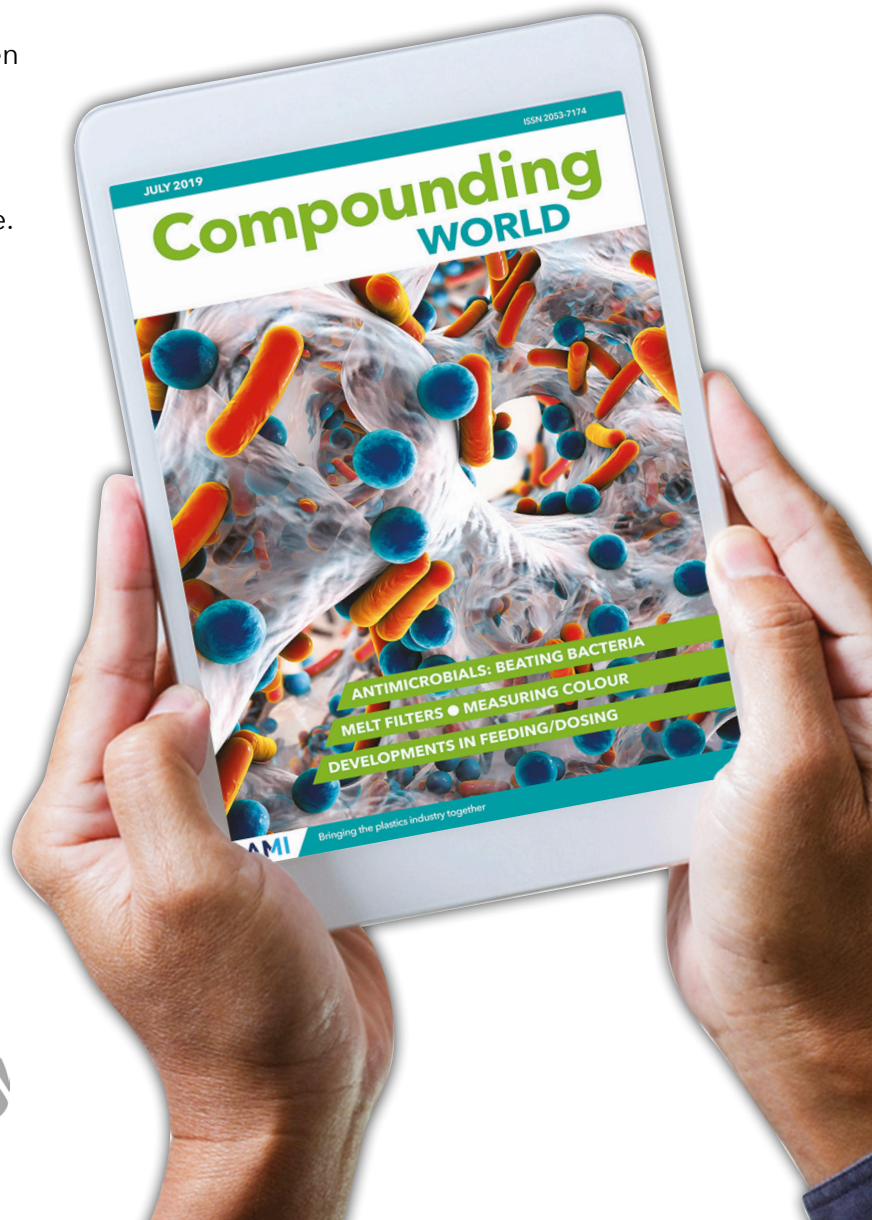

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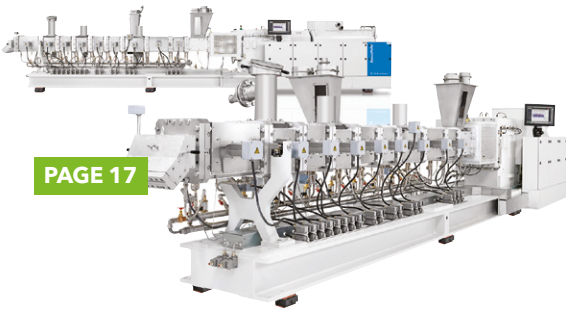

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Ascend buys Italy's Poliblend

PA66 producer Ascend Performance Materials has acquired Italian technical compounder Poliblend and colour and colour masterbatch producer Esseti Plast, which share a production site at Mozzate, from D'Ottavio Group. The move gives Ascend a second compounding site in Europe – it acquired Tilburg, Netherlands-based Brittania Techno Polymer (BTP) in 2016.

Poliblend produces technical compounds based predominantly on PA6 and PA66, as well as some POM and PBT-based products and "circular" grades produced from PCR and PIR polymers. It has an annual capacity of around 35,000 tonnes. Esseti Plast produces colour masterbatches and has capacity of around 5,000 tonnes.

An attraction for Ascend is Poliblend's diverse customer base, according to Ascend President and CEO Phil McDivitt. "We have traditionally been a very auto-centric engineering plastics business – the [Poliblend] business has some component of automotive but a large component of non-auto," he said. "We see, with the way the world is moving in terms of e-mobility and different types of materials, the extensive colour capabilility at Esseti Plast and Poliblend being a strategically important part of the acquisition for us and something we can leverage on a global basis."

IMAGE: POLIBLEND

Ascend has acquired the Poliblend/Esseti Plast facility at Mozzate in Italy

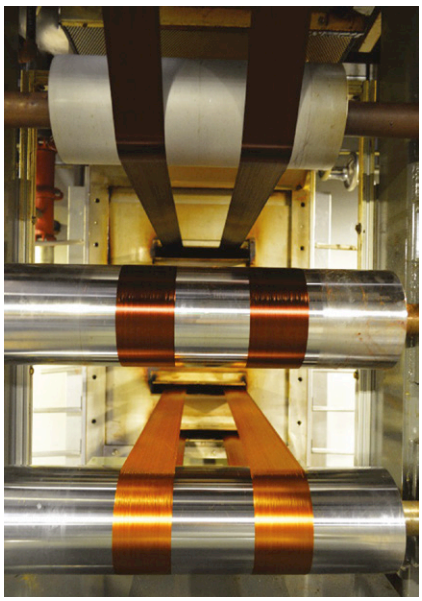
Access to Poliblend's expertise in PA6 and recycled compounds is also a big attraction. "At the K fair we announced the development of our long chain polyamide business and our development of high temperature nylons…that's where we are driving towards," said McDivitt. "Our own internal developments on higher value grades like 610 and 612 and high temperature nylons will fill out part of that portfolio. We see Poliblend giving us the ability to fill out some gaps that we have in terms of non-auto, colours, recycled grades and give us the ability to offer nylon 6 as well."

Unlike BTP, which had toll-compounded some 15,000 tonnes of material annually for Ascend prior to its acquisition, the PA66 specialist has no previous relationship with Poliblend. And, while it has converted the BTP operation to a near 100% Ascend production facility, it plans to continue to service Poliblend and Esseti Plast's customers.

"I would expect that in Europe, between BTP and Poliplast, we would be completely self-sufficient. Then, what we would also look to with Poliblend from a capability standpoint, is translating that capability into our US operations," McDivitt said. "We are in the process of adding some additional capacity at Foley [in Alabama], which we think the capabilities of Poliblend would match up nicely with."

Poliblend President Giancarlo D'Ottavio will join Ascend's European Management team.

› **www.ascendmaterials.com**
› **www.poliblend.it**



Montefibre invests €16.5m in carbon fibre operation

Montefibre Carbon is investing €16.5m at its carbon fibre precursor production plant at Miranda de Ebro in Spain to produce polyacrylonitrile (PAN) precursor for conversion to semi-aerospace quality carbon fibre.

The investment, which includes €11.5m from the Spanish Ministry of Industry, will also include a high performance 100 tonnes/yr carbonisation line. That will be operational by the end of 2021 and will be the first owned by a Spanish company.

With a 40-year history in speciality acrylic textiles, Montefibre is in the process of adapting four of its seven spinning lines to produce some 17,000 tonnes/yr of large-tow PAN. First quantities of its M500 and M600 grades will reach the market in 2020.

The company said the carbonisation investment will make it Europe's third largest producer of carbon fibre, behind SGL of Germany and Solvay in Belgium.

› **www.montefibrecarbon.com**

EU classifies TiO_2 as an inhalation carcinogen

The EU moved last month to classify TiO_2 as a category 2 suspected carcinogen by inhalation under its classification, labelling and packaging (CLP) regulation of substances and mixtures.

The move follows an opinion from the Risk Assessment Committee (RAC) of the European Chemicals Agency (ECHA). This has been consistently challenged by the Titanium Dioxide Manufacturers Association (TDMA), which argues that it was not based on new scientific evidence or understanding of potential harms and is contrary to available data of more than 24,000 workers demonstrating no link between exposure and cancer in humans.

IMAGE: SHUTTERSTOCK

New CLP rules apply to substances/mixtures containing TiO_2 from 2021

While TDMA acknowledges that the EU has attempted to limit the classification of TiO_2 to powders –the regulatory text refers to "powder TiO_2 and mixtures placed on the market in powder form containing 1% or more of TiO_2 which is in the form of, or incorporated in, particles" – it said the text introduces several new concepts and terms without providing meaningful definitions or interpretative guidelines. It predicted this will open the door to various interpretations.

"The EU's decision will apply on 9 September 2021 and the time until then will be needed to attempt to address ambiguities created by the text," according to the association.

› **www.echa.europa.eu**
› **www.tdma.info**

Ampacet acquires LIAD

Masterbatch producer Ampacet has acquired LIAD Weighing & Control Systems, a maker of feeders, blenders and real-time colour management technologies for the plastics industry based in Israel.

Founded in 1979, LIAD has developed an in-line, multi-probe spectrometer for continuous and real-time colour quality measuring. It also manufactures single-component gravimetric feeders for injection moulding machines.

Ampacet CEO and President Alvaro Mendoza said the company "is entering into a new era of delivering holistic solutions to our customers and preparing the stage to enter into new markets with a different value proposition". It has established a new business unit – CISystems Colour Integration – to distribute LIAD's products in North America.

› **www.ampacet.com**
› **www.liad.co.il**

Foster teams up with LioChem

US-based Foster Corporation, which specialises in plastics for medical device and pharmaceutical applications, has formed a partnership with masterbatch and colorant firm LioChem.

The company said the arrangement will allow it to use LioChem's capabilities to augment its own capacity and to extend the colour matching expertise and speed of service it offers. Terms were not disclosed.

LioChem supplies its custom formulated Lioplax MD range of colour masterbatch products for the medical device market.

› **www.fostercomp.com**

IMAGE: BASF

Techmer PM and BASF are offering custom coloured Ultrason grades in US

Custom medical colours

Techmer PM and BASF are now offering Ultrason S, P and E (PSU, PPSU and PESU) polyarylsulphone medical grades in custom colours in the US.

Used to produce products such as medical devices and sterilisation trays, all grades comply with USP Class V or VI and ISO 10993 requirements. Small volume orders will be supplied through Techmer PM's Hifill brand; larger volumes will be supplied directly by BASF.

According to Hung Pham, Ultrason Strategic Business Manager at BASF, the new grades will help customers evaluate and determine suitability faster by removing the custom colour blending process.

› **www.basf.com** › **www.techmerpm.com**

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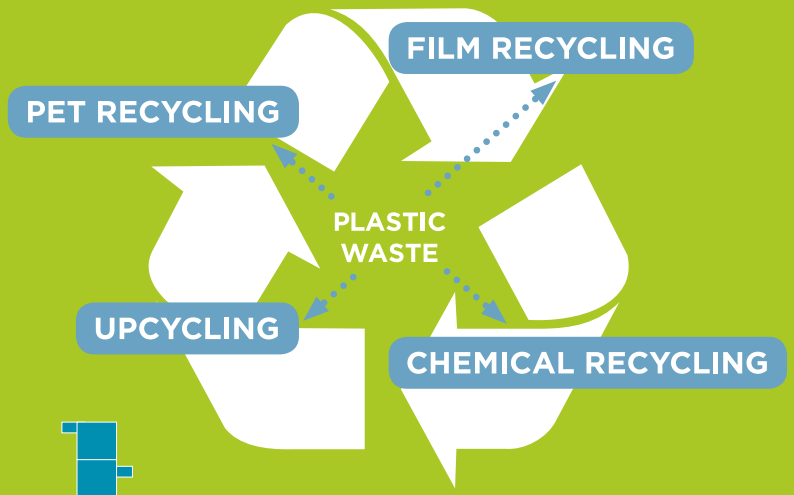

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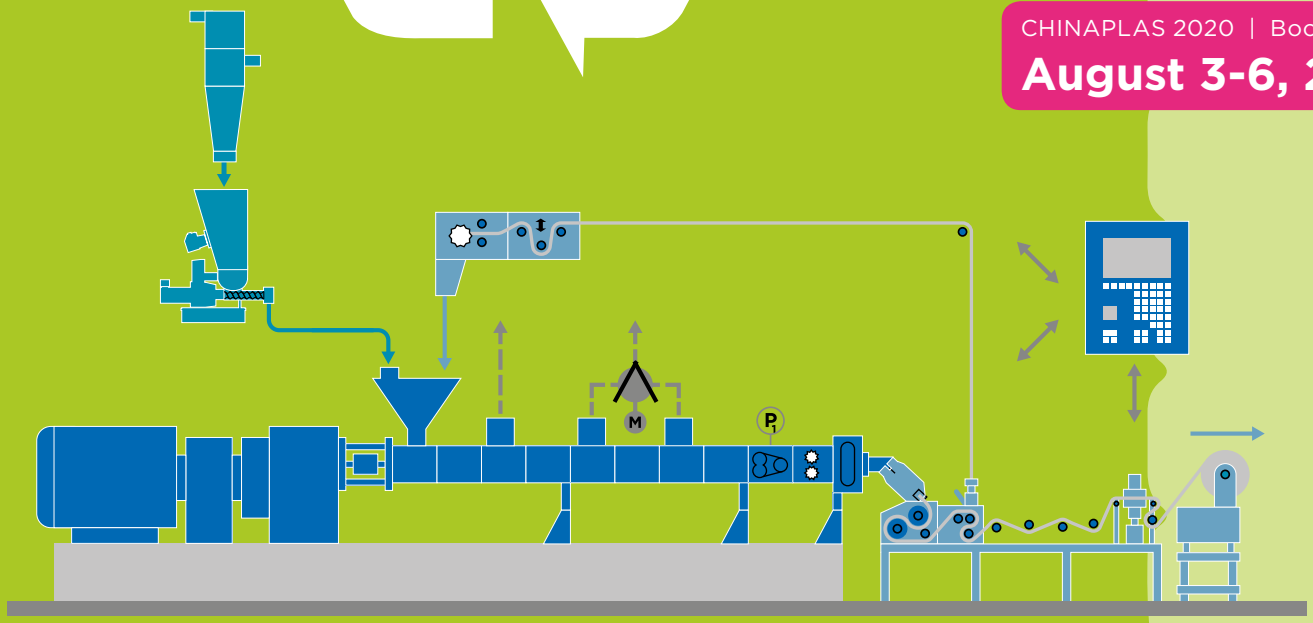

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Kraiburg lightens TPEs

Kraiburg TPE has launched three low density foam-free Thermolast K grades that use Glass Bubble technology from 3M.

The new TPS grades are targeted particularly at automotive and power tool applications. The use of 3M's hollow borosilicate glass sphere additive allows density to be reduced to 0.7-0.9 g/cm³ without hampering processability or reducing mechanical performance and surface quality.

Thermolast K LW/UV is a UV resistant grade for exterior vehicle components; Thermolast K LW/CS/UV extends this of offer increased compression set and good adhesion to PP, making it suitable for sealing applications; Thermolast K LW/PA is a flame retardant grade designed for adhesion to PA.

› **www.kraiburg-tpe.com**

Polykemi adds capacity with new investment

Swedish compounder Polykemi completed a €4.2m annual investment programme at its Ystad facility at the end of last year with the installation of a new 92mm compounding line.

The company's largest single machine investment to date, the 92mm Coperion extruder replaces an older machine and is connected to a new automatic materials handling system. It lifts production capacity at the site, which operates 25 compounding lines, by around 5,000 tonnes and takes group capacity to more than 70,000 tonnes.

"This new production line is today our most productive unit," said Polykemi Technical Manager Peter Åkesson. "We have reached a new level of efficiency that has further increased the accuracy of our products."

The investment follows the start-up of a 58mm Coperion line during the summer of 2019, which was configured for production of flame retardant compounds for the growing EV market.

IMAGE: POLYKEMI

New 92mm line is Polykemi's largest single machine investment

Despite a slowdown in market activity in the second half of 2019, Polykemi said the company posted positive growth for the year. Polykemi Sales Manager Mattias Persson said it had secured more than 100 new projects and group volumes – the company has production sites in Sweden, China and the US – had grown by more than 4,000 tonnes. Sales for 2019 exceeded €100m.

Polykemi said it expects 2020 investment in its production operations to be at a similar level to 2019, with the key focus on improving operational efficiency.

› **www.polykemi.com**

Ineos caps recycling with Forever deal

IMAGE: INEOS OLEFINS & POLYMERS

Ineos aims to recycle 6.5bn caps over five years

Ineos Olefins & Polymers has established a partnership with Italian recycling firm Forever Plast under which it will take post-consumer PE from used bottle caps and blend it with virgin polymer to create new cap grades. They expect to recycle 6.5bn caps over the next five years.

The products, branded Recycl-IN, are said to offer the same mechanical properties as virgin types and will be processible in existing injection moulding and compression moulding machines, the company said.

Ineos said the project is "part of its ongoing drive to support a more circular economy and significantly increase plastics recycling." This includes offering a range of polyolefins for packaging applications in Europe containing 50% or more recycled content and incorporating at least 325,000 tonnes/yr of recycled material into products by 2025.

› **www.ineos.com**

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KraussMaffei cuts jobs; continues investments

KraussMaffei is to cut around 550 jobs from its global operations. Most of the cuts will fall in Germany, which will see 330 posts go this year and a further 100 by 2022.

The company said that the cuts were necessary "to maintain and strengthen its competitiveness in an environment that is challenging for all market participants." It said it hoped to avoid compulsory redundancies and would explore options such as part-time working.

The move comes as KraussMaffei embarks on the largest investment in its history, with a "three-digit million Euro amount" earmarked for new production facilities at Munich-Parsdorf, Hanover-Laatzen and Einbeck in Germany. "This will enable KraussMaffei to expand its global position and strengthen Germany as a business location," the company said.

Headquartered in Munich in Germany, KraussMaffei was acquired by ChemChina in 2016 and launched on the Shanghai stock exchange in January last year. It manufactures injection moulding, extrusion and PU processing machinery and generated sales of around €1.5bn in 2018.

› **www.kraussmaffei.com**

DSM invests in US compounds

DSM is to expand capacity at its high-performance materials compounding site at Evansville in Indiana, US. The company said the investment, which will be completed in Q3 2021, will prepare the site to produce advanced thermoplastic compounds, including bio-based types, for EVs, metal replacement and lightweight applications.

"As demand from our customers for sustainable sources of advanced materials grows, so does our need to invest", said Jud Gibson, Vice President Commercial Americas at DSM Engineering Plastics. "The expansion of our North American operations helps to ensure we have the right tools to meet this need today and in the future."

DSM has identified North America as a key growth market for its business.

› **www.dsmep.com**

REACH breaches flagged

The number of incidences of REACH non-compliant chemicals found in consumer products in the EU grew by 24% in 2019 to 1,468, with more than 92% from outside the EU and EEA countries, according to analysis of RAPEX safety alert data by European chemical trade body Cefic.

Around 25% of incidences involved phthalates, mostly in toys, Cefic said. Other key chemical incidences involved boron, lead and cadmium.

While most of the increase can be attributed to better enforcement of the RoHS Directive, Cefic said it confirms the urgent need for EU member states to step up enforcement of REACH in imported goods.

"It is also important to ensure that restrictions under REACH are actually enforceable. We call for compliance tools and methodologies to accompany every restriction measure," said Cefic Executive Director of Product Stewardship Sylvie Lemoine.

› **www.cefic.org**

Wacker to reduce headcount by 1,000

Wacker Chemie is to reduce its headcount by 1,000 by the end of 2022 as part of a "Shape the Future" efficiency programme aimed at reducing its annual costs by €250m. It employs around 14,555 globally.

The company said 80% of the job losses will fall in Germany, where it currently employs some 10,000 people. It said it hoped to avoid compulsory layoffs.

"We are preparing for a harsher competitive environment – both in our polysilicon business and at our chemical divisions," said CEO Rudolf Staudigl. "Our aim is not only to achieve significant cost-savings but also to decisively strengthen Wacker for tomorrow's challenges and secure a long-term competitive edge."

› **www.wacker.com**

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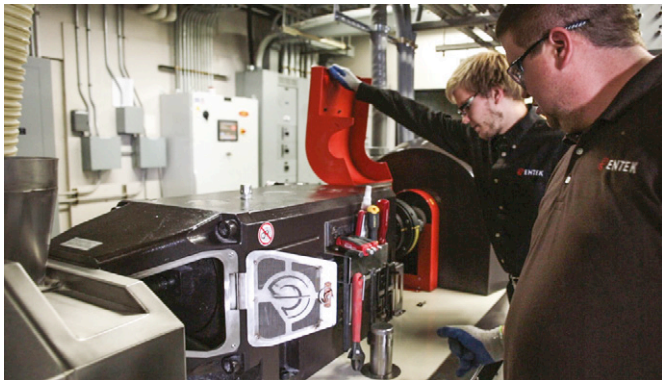

ENTEK manufactures its twin-screw extruders and replacement wear parts at its corporate headquarters in Lebanon, Oregon USA. Pictured is the ENTEK QC³ 43mm twin-screw, co-rotating extruder with market-leading quick-change, quick-clean, and quality control features.

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AMI announces free expo conference programme

Compounding World publisher AMI has announced the conference programme for the Compounding World Expo, which takes place at Messe Essen in Germany on 3-4 June 2020 and includes two free-to-attend conference streams hosting industry debates, training seminars, technical talks and market forecasts.

The programme includes three business debates focused on technical compounds, masterbatch and cable compounds. Thes will feature senior representatives from ACI, ACOME, Albis, Eurotec, Lifocolor Farben, PolyOne, Prysmian, Sirmax and Washington Penn. There will also be a discussion of REACH legislation hosted by European Masterbatchers and Compounders (EuMBC) and featuring speakers from LyondellBasell and Mixer.

Training seminars will cover a range of practical topics and include: venting problems on twin-screw extruders; computer simulation of reactive extrusion; trouble-shooting compounding problems; ensuring REACH compliance; and predicting the impact of fillers on compound properties.

The programme also includes more than 20 expert technical presentations covering topics such as: conductive compounds; polymer stabilisation; functional fillers; continuous mixers; pelletising; compatibilisers; flame retardants; quality control; antimicrobials; compounding TPEs; recycled plastics formulation; and measuring and extruder wear.

Each day of the Expo will begin with a keynote address. On the first day, Andrew Reynolds, director of Advance Bidco (AMI's parent company), will provide insight into global trends in plastics compounding markets. The second day will start with a presentation by *Compounding World*'s editor-in-chief, Chris Smith, highlighting some key compounding technology innovations.

Download the full Compounding World Expo conference programme **HERE**. Register **HERE** to guarantee your free ticket. Your pass will also give you free admission to the Plastics Recycling World Expo, Plastics Extrusion World Expo, and Polymer Testing World Expo. In total, there will be more than 300 exhibitors throughout the four shows and more than 120 speakers across the five free conference theatres.

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

This event has been postponed to 7-8 October 2020. More details HERE

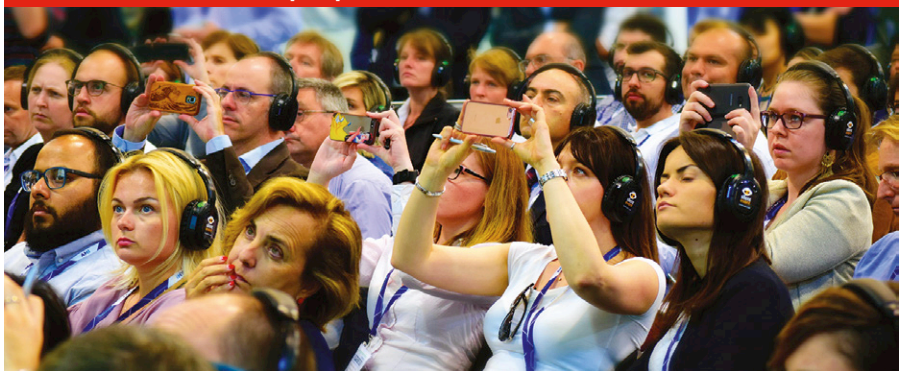

IMAGE: AMI

The free Compounding World Expo conferences proved highly popular in 2018

Vinnolit adds more paste PVC capacity

Vinnolit has commissioned a plant expansion for production of paste PVC using its microsuspension technology at its site at Burghausen in Germany.

The investment included new reactors, a nine-storey building for a new dryer, and an expansion and modernisation of the control room. The company also added new silos, a bagging plant and palletising system, and a new recycling system for process cooling water.

Microsuspension production technology is already in use at the company's Hillhouse site in Thornton Cleveleys, UK. "Thanks to this technology, we can give our products very flexible, tailor-made processing properties, as they are particularly in demand in the manufacture of floor coverings, wallpapers and technical coatings," said Vinnolit Managing Director Dr Karl-Martin Schellerer.

› **www.vinnolit.com**

IMAGE: VINNOLIT

Left: Vinnolit's Burghausen investment includes new paste PVC reactors

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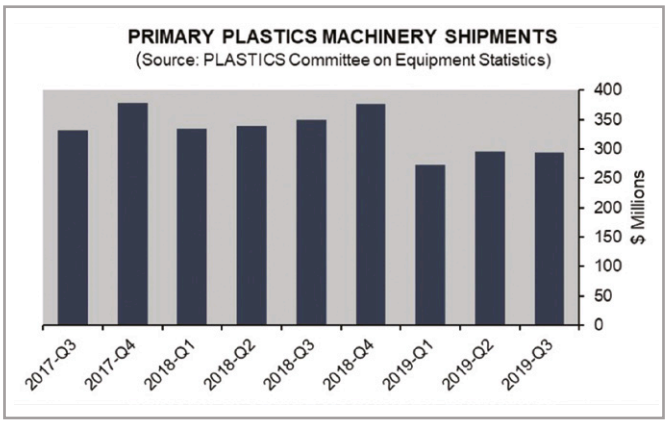
US machine shipments down 16%

US primary plastics machinery shipments in the final quarter of 2019 totalled $316m, up on the previous quarter but down by 16% on the same period in 2018, according to data from the Plastics Industry Association's Committee on Equipment Statistics (CES).

CES has not published full-year figures, but compiling previously published quarterly release numbers shows that shipments for the whole of 2019 were about 16% down on 2018 at $1.18bn.



Shipments of twin screw extruders declined by 7.7% in the final quarter of last year. Shipments of single screw extruders were also down – by 0.9% – but injection machinery posted a 9.6% gain.

The association's Chief Economist Dr Perc Pineda attributed the weaker figures to "uncertainties from trade and tariffs, and overall weaker manufacturing activity". Both exports and imports of primary machinery also fell in Q4.

He said that moderate growth is expected for the coming year but, if recent positive developments on trade and tariffs translate into improved confidence and interest rates stay low "we could see better numbers for plastics machinery shipments".

› **www.plasticsindustry.org**

Vynova launches "bio" PVC

Vynova has launched a range of "bio-attributed" PVC resins. Available for both rigid and flexible applications, the new grades will be offered in a range of K-values and will be produced at its sites at Beek in the Netherlands and at Mazingarbe in France.

The resins are manufactured using renewable ethylene from second-generation biomass feedstock from SABIC's facility at Geleen in the Netherlands. The company said that this will reduce its fossil feedstock requirement and cut CO_2 emissions by more than 90%.

Vynova said the materials carry ISCC Plus certification.

› **www.vynova-group.com**

Clariant connects FAKRA colours

Clariant has announced a range of 14 new colour masterbatches formulated to meet the performance requirements of the new FAKRA high speed data connectors for automotive applications.

FAKRA connectors will be rolled out on new cars from 2021, according to the company. They provide 6 GHz of bandwidth to handle 5G cellular/data traffic for automotive monitoring, diagnostic, safety, performance, navigation, and entertainment systems. The FAKRA standard details 14 standard plug/jack combinations, each assigned with a colour and a coded mating configuration to prevent mis-connection. They will typically be moulded in PA66, PPA or PBT due to temperature requirements.

Meeting the required levels of performance for this application is a challenge, according to Peter Dufour, Global Segment Head and Business Development for Consumer Electronics, Electricals and Electronics at Clariant Masterbatches.

"When mixed with natural resin, these new masterbatches produce materials that not only meet FAKRA standards for colour, mechanical properties and melt flow, but also meet UL94 flammability resistance requirements without the use of halogens or SVHCs, either UL94 HB or V-0 rated."

› **www.clariant.com**

Smart investment for IKV

The Institute for Plastics Processing (IKV) at RWTH Aachen University is to build the Plastics Innovation Centre 4.0 (PIC 4.0) on a 4,200 m^2 site at Seffenter Weg in Aachen, Germany.

The state of North Rhine-Westphalia and the European Regional Development Fund are funding the €19.5m project.

PIC 4.0 is described as "a completely interconnected R&D environment", which will enable IKV to carry out training in the digitisation of plastics processing. Its integrated research infrastructure will also provide a testing environment for future developments within RWTH Aachen's Internet of Production 'cluster of excellence', it said.

› **www.ikv-aachen.de**

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IMAGE: COPERION

Tuning up for the future

*The twin screw extruder may have been the mainstay of the compounding industry for decades but **Peter Mapleston** finds that suppliers can still extract more from this flexible workhorse*

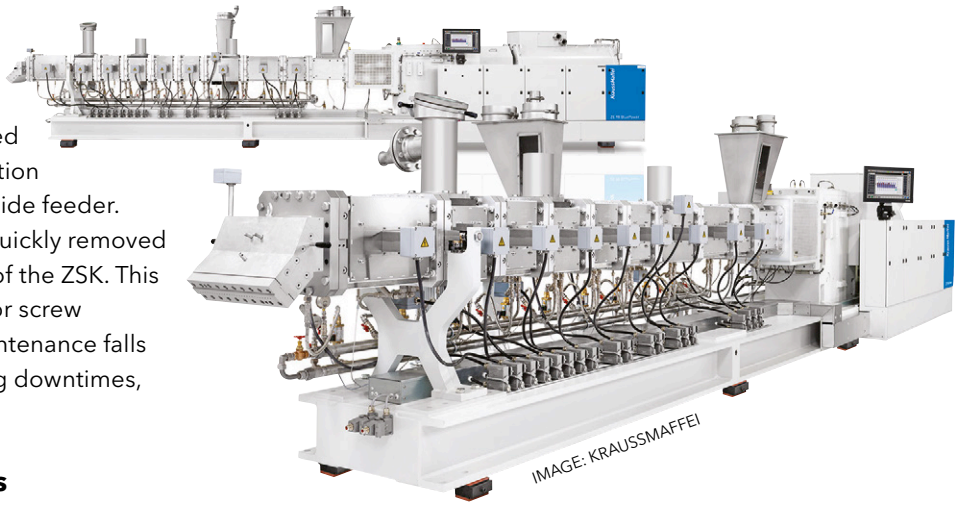
For a technology as mature as twin-screw compounding extruders – which boast a history of at least 60 years – it is little surprise that development is now focused more on evolution rather than revolution. However, that evolution remains significant and technology suppliers continue to fine-tune their offerings in terms of performance, at the same time filling gaps in their ranges and expanding application possibilities.

An example of these trends can be seen at **KraussMaffei** (the long-standing KraussMaffei Berstorff brand was fully merged into its parent group last year and the Berstorff name dropped). It has been busy extending its ZE BluePower high-performance compounder series, which first appeared in 2013 and was supplemented with a laboratory model three years ago. At last year's K2019 show in Germany, it added four large models with outputs over 2,500 kg/h. Like all models of this series, the new sizes – 98, 122, 142 and 166mm – feature large free volume and high specific torque and offer flexible configuration options for screws and barrels.

Matthias Sieverding, President of the Extrusion Technology Segment at KraussMaffei, says the new units are designed for compounders with high production capacities "where maximum reliability in 24/7 operation is a must." The company says the combination of large free volume and high specific torque enables the ZE BluePower to be used for compounding engineering plastics and highly filled formulations. The 1.65 OD/ID diameter ratio means that free volume is 27% higher than the previous ZE UT extruder series; torque density is 36% higher at 16 Nm/cm^3.

Development emphasis has been placed on ease-of-operation and energy efficiency in the latest generation of high performance ZSK twin screw extruders from **Coperion**. Models now come with one-piece insulation covers that can be detached without removing the cartridge heaters (and that also better insulate the process section). Another improvement is the use of pluggable cartridge barrel heaters that can be easily removed for maintenance very quickly. The gearbox lantern can also now be optionally equipped with an electronically secured maintenance opening. This means service personnel can open it without tools as soon

Main image: More sophisticated control systems and improved operational and maintenance features are lifting productivity of twin screw compounding machinery



Right: Krauss-Maffei has extended it ZE BluePower family to include four new large diameter models ranging to 166mm

as the screw shafts come to a complete stop.

The company has also completely overhauled its ZS-EG side-devolatilization unit and ZS-EG and ZS-B side feeder. These can now be more quickly removed from the process section of the ZSK. This means the time needed for screw changes, cleaning, or maintenance falls significantly, so minimising downtimes, Coperion says.

Digital developments

As part of its ongoing digitalisation initiatives – branded under the C-Beyond 4.0 banner – Coperion launched new control technology for its extruders. The design is said to be more powerful and features a more user-friendly HMI (human machine interface). It will be equipped with an OPC 40084 interface in the middle of 2020. OPC 40084 is based on the OPC UA machine-to-machine communication protocol for industrial automation and is specifically intended for extruder communication with higher ranking manufacturing execution systems (MES). It was jointly established by the Euromap association of European plastics and rubber machinery manufacturers, Germany's VDMA mechanical engineering industry association, and leading plastics machinery manufacturers.

The extruder controls enable the integration of a number of intelligent functionalities, summarised under the Smart Machine name. These include alarm-based handling recommendations, process monitoring, and predictive maintenance features based on diagnostic data. The new HMI was displayed on ZSK 70 Mc^{18} and ZSK 45 Mc^{18} machines during the K2019 exhibition and the company said feedback from visitors was "consistently positive."

Recycling is one of the fastest growing areas of interest in the compounding industry at present and Coperion says it is an application area where the high torque and gentle processing of the ZSK make it well-suited. "Client feedback at K2019 reflected this strength of the ZSK," it says. "Additionally, clients reported a high degree of flexibility and efficiency."

The company says the highly modular basis of its ZSK design means that it can be implemented for a wide variety of applications in compounding of recycled plastics, such as reprocessing polymer regrind, manufacturing films, PET recycling, or for "upcycling" of various materials. With recycling of PET in particular, the ZSK can save energy and time as pre-drying and crystallisation can be omitted in the single-stage production process. In addition, only minimal iV degradation occurs during reprocessing. Pelletised new product and different regenerated material (ground product, agglomerates, flakes) can be processed together, even if they have different iV values.

Coperion has also added a new 25mm laboratory extruder to its STS Mc^{11} series. It features a simple operator-friendly design and is easy to clean due to the use of an exchangeable sleeve insert in the barrel and a quick-release die head. Water cooling, vacuum unit and air supply can be integrated into the base frame as an option. Cartridge heaters provide precise single-zone heating of each individual barrel. The STS Mc^{11} has the same Do/Di ratio of 1.55 and the same maximum specific torque of 11.3 Nm/cm^3 as other STS Mc11 extruders series, so production parameters can be reliably scaled, the company says.

Below: Latest edition to Coperion's STS Mc^{11} line is this 25mm laboratory model

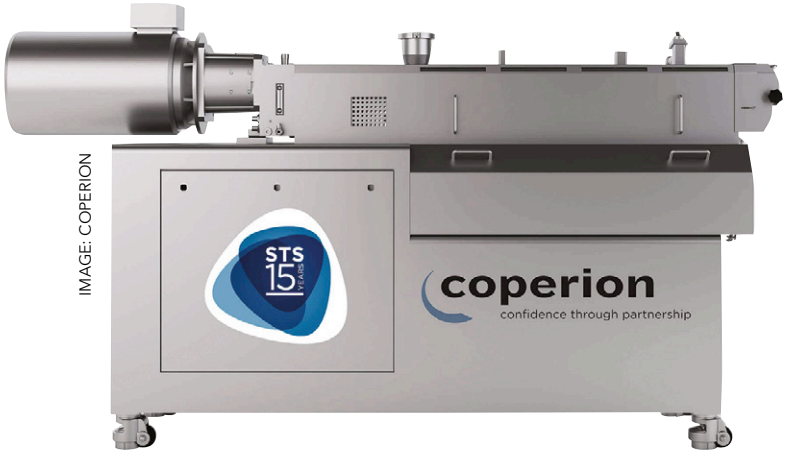


IMAGE: COPERION

Modular benefits

Turkish equipment producer **Polimer Technics** also highlights modularity in its poex T series machines. The company uses two kinds of barrel – solid for poex T27 extruders and a liner insert barrel for the

IMAGE: POLIMER TECHNICS

Above: A poex recompound complete recycling system by Polimer Technics

larger poex T40, T50, T60, T75 and T94. Both types are modular. "These modular systems enable easy assembly and disassembly, easy cleaning and maintenance, and excellent heat transfer," the company says. They also provide flexibility in positioning side feeders.

Polimer Technics used the K show to unveil its new poex Smart Touch control panel, with integration to the poex T40 extruder. This is equipped with a remote maintenance feature and allows additional interactive service options to be installed at a later date. Poex Smart Touch is claimed to substantially enhance ease of use and reduce set-up times during compound changes, with a clear menu structure used to guide the machine operator through all process steps. All relevant peripheral components and downstream equipment can be controlled too, using standardised interfaces. Control of the extruders via iOS mobile devices is also possible.

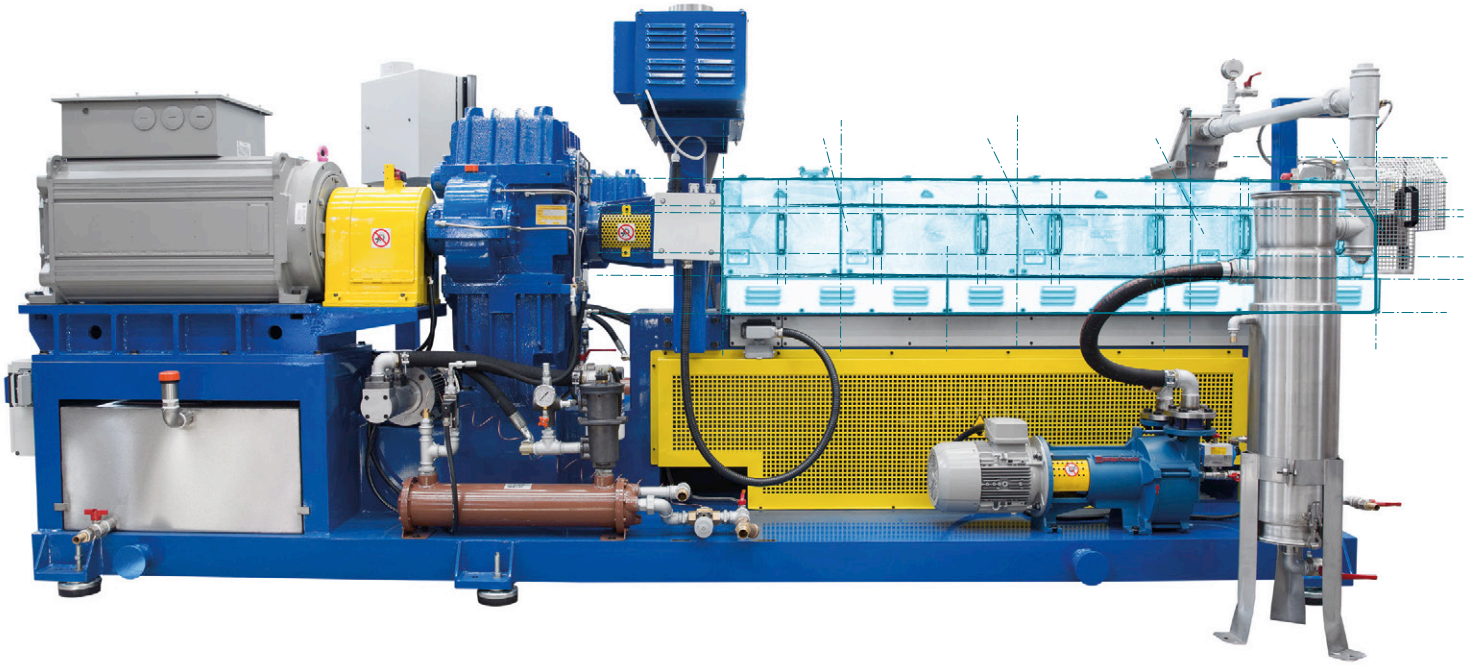
Modularity is also a key contributor to the performance of the company's poex recompound systems, which it has been promoting for some years for production of high value 'upcycled' recycled compounds. It says these can be configured to produce homogeneous products from input materials of different MFI values and containing many different fillers and additives.

Design overhaul

Shown at the K2019 exhibition in a 27mm version, **Leistritz** is rolling out a new version of its ZSE iMaxx twin screw compounding extruder across its 18, 27, 35, 40, 50 and 60mm models. The most obvious change is the machine cover, which is manufactured in stainless steel and covers the barrel as well as the side feeder, but the company points to a whole host of operational and performance enhancing improvements beneath the surface.

Access to the water manifold has been improved (and water components are now completely separate from the electrics), the temperature control unit is integrated into the machine frame together with the coax valves, a high efficiency gearbox is fitted with an energy-saving synchronous motor, and the barrel can now be fully insulated.

Other changes include the introduction of quick replacement cartridge heaters that are accessed via the terminal block. A new simplified shaft coupling system has also been developed and the die-head has been redesigned to allow it to swing away from the machine after releasing just two bolts. ›



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Right: New covers on the latest ZSE iMaxx extruder from Leistritz are the most obvious of many design improvements

Improving control and insight into the compounding process is critical in achieving optimal production efficiency, a point demonstrated in a recent technical paper by Leistritz President and General Manager Charlie Martin and Assistant Lab Manager Brian Haight. "Almost every product benefits by strategically managing how shear and energy is imparted to the materials being processed," they claim.

Martin and Height refer to experimental data generated comparing Do/Di 1.5 and Do/Di 1.66 model extruders with interchangeable process sections mated to the same gearbox. Initial tests were carried out with a neat powder PE resin with a 40:1 L/D process section and 40hp motor. Further experiments were performed to compare the resulting melt temperature for different melting zone screw configurations with a 2 MFI PP pelletised resin.

The screw design in the melting zone directly impacts the melt temperature, and is significant, say Martin and Haight. "Temperature setpoints in this zone will also contribute to the melt temperature. Perhaps counter-intuitively, higher setpoints generally result in a lower melt temperature. Often overlooked, pressure generation at the discharge of the TSE also adds to the melt temperature. The more restrictive the front end, the higher the pressure and corresponding melt temperature."

Large-scale applications and growing consumer interest are resulting in a greater call for biodegradable products in several compounding processes, according to **Comac**, which says it has developed customised processing solutions for various types of biomaterials. "The combination of our twin-screw extruder, designed for gentle mixing, with specific degassing and liquid injection systems allows us to get optimal results in terms of quality and production capacity," the company claims.

Comac has developed systems that accommodate the specific processing needs of PLA and starch-based polymers. "To allow gentle mixing we have studied an optimised screw profile

KM inline system colours the future

KraussMaffei used its K2019 display in Dusseldorf, Germany, last year to demonstrate automated and fully closed loop controlled production of coloured compounds. Running on a 42D ZE 28 Bluepower laboratory extruder, the exhibit was upcycling PP scrap and combined liquid colour, inline spectral photometry, and full recording of process data.

Above: KraussMaffei's Liquid Color Compounding technology was running throughout the K2019 show

KM considers its Liquid Color Compounding technology as highly suitable for masterbatch manufacturers, in particular, who need to respond flexibly to customer demands. Because the liquid colours are metered directly in to the extruder, there is no need for the conventional intermediate step of manufacturing a monoconcentrate, which makes the process especially economical and suitable even for very small volumes and special colours. The company says that even converting from dark to light is possible without any problem due to the self-cleaning effect of the twin-screw extruder. During the demonstration, the line was automatically switched between nine different colours for a PP masterbatch charged with talc.

The spectral-photometric inline monitoring system used high-resolution glass fibre sensors to measure the light reflected by the melt during the process, comparing this with a defined target value to detect even the slightest difference in brightness or colour in real time. This was then automatically corrected in real time with no need for sampling and no loss of material.

The ZE 28 BluePower also collected and recorded production data synchronously throughout the demonstration, including pressures, temperatures, rotational speeds, volume flows of all upstream and downstream components. Metering units and pelletiser were also integrated together with the extruder in the overall system control.

› **www.kraussmaffei.com**

Mixer or pump?

The twin screw compounding extruder is an excellent mixing device but a poor efficiency pump, says Dean Elliott, Technical Processing Manager at US-based machinery maker Entek. "This is manifested as undesirable temperature rise of the molten compound occurring mostly at the screw tips," he says.

Elliott and his team have been running tests at the company's pilot plant in Lebanon, Oregon, that aim to minimise this risk by making some simple processing changes without incurring capital expenditure. In a trial running a 50% talc filled MFI 12 polypropylene masterbatch on a 43mm co-rotating twin screw extruder they found that 40-pitch convey screw elements (CoC-2-40) performed best, while 60-pitch convey (CoC-2-60), single flight convey 60 pitch (CoC-1-60) and undercut feed 60 pitch elements (CoF-2-60) all performed the same. Running the last two barrel sections at significantly lower barrel temperature set points significantly reduced compound melt temperatures.

The trial was carried out by installing three different restrictions at the outlet of the extruder to simulate low, medium and high back pressure and the final 240mm (5.5 L/D) of convey elements on the extruder screw configuration were altered with different styles and pitches. "Tribal knowledge amongst TSE [twin screw extruder] users is that the tighter the pitch of the screw element, the more efficient the pumping. We learned that this is true, however, once the pitch becomes tighter than 1D the pumping becomes less efficient," says Elliott.

While pumping performance can be optimised it does not match a melt pump. "What this study showed was that a convey screw element with a pitch equal to the diameter of the screw is best for pumping," says Elliott. "The co-rotating TSE remains an inefficient pump at roughly 5 to 15% efficient...the melt pump is roughly 25 to 35% efficient."

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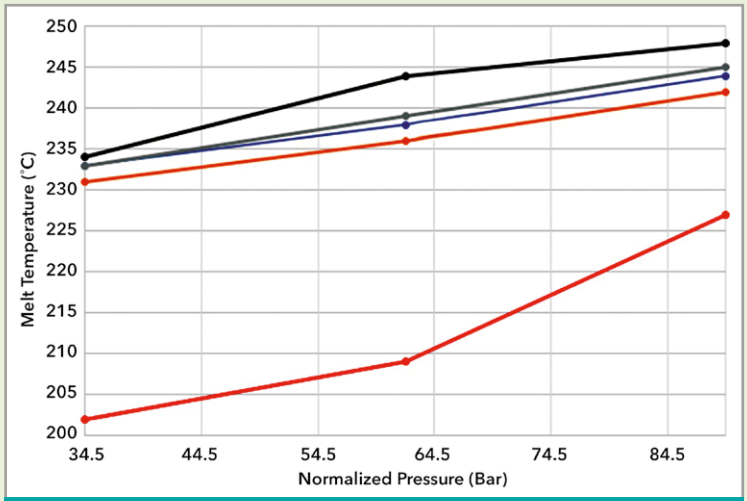

Graph showing the relationship between pressure and exit melt temperature according to convey elements used (from top: 80 pitch, 60, 30, 40, 40 with last two barrel sections around 110°C colder than upstream sections. 43-mm extruder, 200rpm, 115kg/h)
Source: Entek

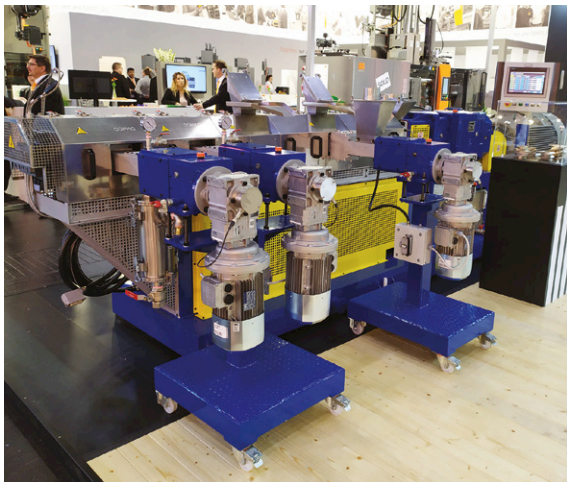

IMAGE: COMAC

Above: Comac was promoting its capabilities in compounding of biopolymers at K2019

combined with a low screw speed, because PLA does not tolerate stress," says a company spokesperson. "The degassing system has been increased (in different points) to extract moisture from materials like starch. Liquid injection systems are required because liquids are necessary to allow starch plastification." The company says a typical extruder size supplied for bioplastic compounding is 92mm, which will provide an output of around 800kg/h.

Custom configuration

Italian company **Maris** says its prime advantage in the market is its ability to customise its co-rotating twin screw machines to the customer's specific needs. "This is true also when it comes to highly filled compounds," the company says. "In order to increase extruder performances over the years, Maris has made numerous technical process improvements maximising, therefore, both the filler percentage and the output capacity."

The most important of these developments are said to include: the ability to offer several Do/Di ratios to provide different free volumes; to offer a wide range of extruders with different specific torques; the possibility to add the filler in four different feeding points (one in the main feed and three in side feeders); incorporation of special equipment – such as a deaeration system – to facilitate the introduction of fillers that incorporate air; and optimisation of the screw profile and screw elements for a particular process. "The synergy of these technical solutions has allowed us to reach filler percentages up to 80-85%, preserving the output capacity and keeping excellent dispersion standards," says a company spokesperson.

Optimisation of screw profiles is also a priority at Japanese compounding extruder maker **Toshiba**

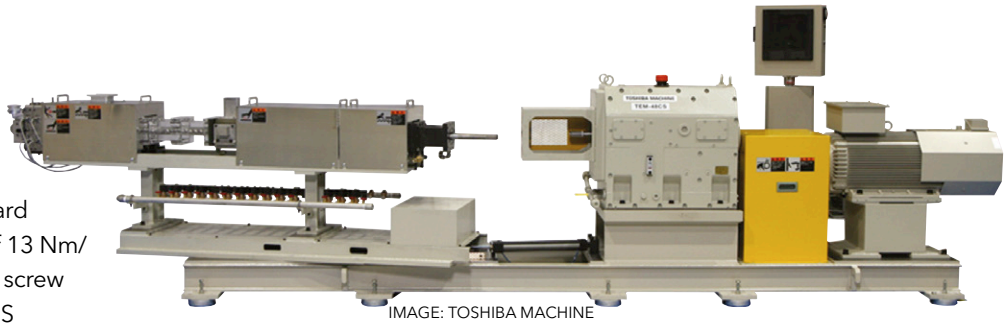

IMAGE: TOSHIBA MACHINE

Machine (which will rename itself Shibaura Machine from April). It offers two basic variants of its TEM series twin screw compounding machines. The standard TEM-SS machine offers a torque density of 13 Nm/cm^3 and can be supplied with standard SS screw elements (Do/Di of 1.56) or deep flight DSS elements (Do/Di of 1.8). The DSS flights provide additional free volume and can improve conveying performance. It also offers a high torque version – TEM-SX – providing a torque density of 18 Nm/cm^3.

The latest addition to its range is the TEM-CS hybrid, which is offered in three variants. The TEM-CS I is fitted with a DSS profile on the upstream section to maximise material conveying capacity and an SS profile on the downstream section to provide optimal mixing. The company says this combination is optimal for low bulk density materials requiring a high level of mixing.

The TEM-CS II variant reverses this layout, placing the SS elements upstream and the DSS elements downstream. A Toshiba spokesperson says this is an optimal arrangement for devolatilastion duties of for reactive processing where the priority is to achieve an initial intensive mixing followed by controlled retention time. Finally, the the TEM-C III variant combines a DSS screw on the upstream side and a triple-flight high dispersion screw on the downstream side with a deeply grooved upstream barrel section. This is said to improve material conveying performance while overcoming the traditional output limitations of a triple flight screw configuration.

Above: Toshiba's TEM CS range are hybrid models combining multiple depth screw sections

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IMAGE: PROTEC POLYMER PROCESSING

LFTs: ready to break out?

Despite their performance benefits, long fibre thermoplastics have struggled to break out of their niche. Peter Mapleston asks whether the latest innovations could change that

Production of long fibre reinforced thermoplastics, LFTs, is and is likely to remain a niche area, at least for the near future. That is not because LFTs are difficult to make (although it is not a simple process either), but rather that the market for the materials remains stubbornly small. There is no doubt that LFTs enable production of injection moulded parts with excellent mechanical properties but extracting the full potential from the materials can be challenging – part design is critical, as is a good understanding of the injection moulding process.

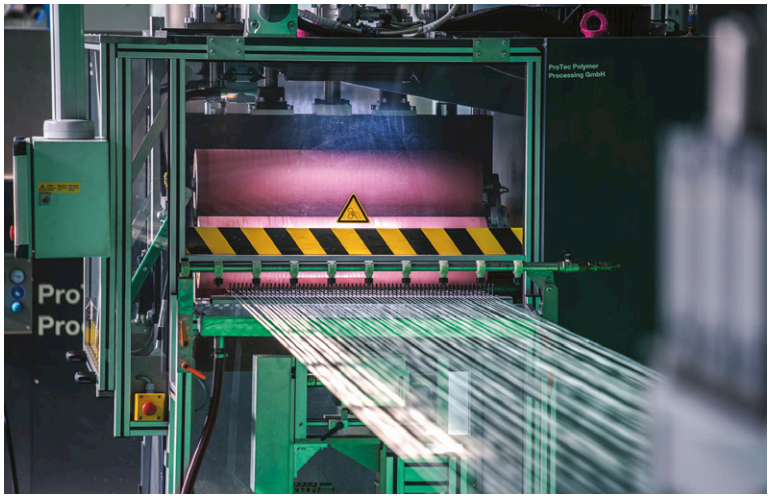
LFTs are also competing in a dynamic marketplace. New thermoplastics processing technologies using continuous fibre reinforcement are emerging to rival LFTs in some areas, while some suppliers of short-fibre compounds claim their products can often offer a better performing all-round package than LFTs. All that said, however, LFT production technology and materials makers are not standing still. There is a fair amount of technological movement in the market, both in terms of improvements to fibre and additive systems and also in the equipment available to make LFTs. We take a look at some of these developments here and also highlight a number of case studies that provide proof that, when done right, designing and processing with LFTs can produce outstanding results.

One area of development is odour reduction. Automotive OEMs have, in recent years, been increasing pressure on suppliers to reduce odour and emissions of VOCs (Volatile Organic Compounds) from parts. Work is going on at many material suppliers, including producers of additives and glass reinforcement, to further reduce emissions from their materials.

Glass fibre maker **Owens Corning**'s latest development, which was launched in China last year, is a low odour single-end roving (SE4818 Low Odor) designed for LFT and continuous fibre reinforced thermoplastic (CFRT) automotive applications. SE4818 meets low odour require-

Main image: LFTs provide very effective solutions for a wide variety of demanding applications but they have stubbornly remained a niche product. New material and production developments may go some way to change that

IMAGE: PROTEC POLYMER PROCESSING



Above: A high-speed retrofit upgrade provides a simple means to boost output from existing ProTec LFT pultrusion lines

ments as measured by standards including VDA270 German Association of the Automotive Industry, PV3900 Volkswagen SAE standards and the Geely Low Odor Test method for demanding OEMs.

"A challenge with developing a product that has proven low odour for our customers is understanding the nuances among the test methods," says Colleen Kennedy, Product Leader Composites at the company. "For example, some OEMs use microchambers for sampling, whereas others use sampling bags. Because methodologies are not yet standardised, understanding these differences and the latest technology available for testing is critical."

It is also important to have a clear understanding of where odours are coming from. "With odour in LFT compounds, there's also a question of source," she says. "While polypropylene is the main culprit in the compound, we leverage our size technology on the glass fibre to reduce odour as much as possible."

Odour also figures in new additive developments from **Songwon**. The company says that emissions from polypropylene are one of the biggest challenges faced by car manufacturers today and those involved in the automotive value chain have been seeking ways of reducing them for many years. "Standards developed to support their efforts are becoming increasingly stringent. Today, China is the country with the strictest regulations," the company notes.

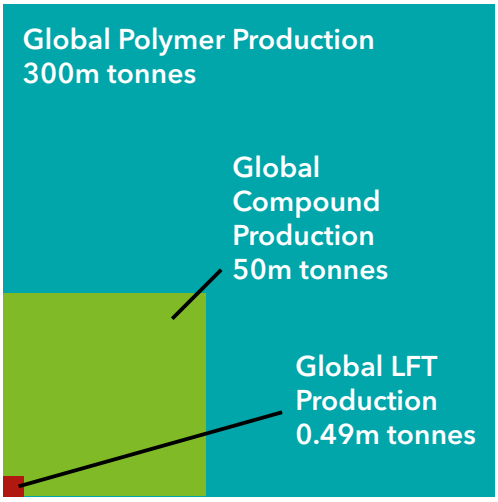
Songwon has developed a range of stabiliser packages for automotive PP and glass fibre compounds – including LFTs – that provide long term stability and reduce VOC emission levels in interior PP-based thermoplastic polyolefin (TPO) automotive applications. Songxtend 2124 is a long-term thermal stabiliser that is claimed to offer triple the heat stability of standard phenolic antioxidants. This makes it well suited for under the hood applications, which are exposed to very high temperatures.

Songxtend 2123 is a long-term thermal stabiliser that prolongs the life of PP automotive interior parts. To help manufacturers meet application requirements while reducing emissions, it needs to be combined with a low VOC processing stabiliser. Songwon says it developed Songxtend 1103, a high-performance product with excellent compatibility with the polymer matrix, for this purpose.

Performance upgrades

K2019 saw the introduction of a high-speed retrofit upgrade for **ProTec Polymer Processing**'s LFT pultrusion lines. The company says the retrofit provides an easy way to boost the production output rates of its existing manufacturing lines for high quality pellets from 30 to 50 m/min. The biggest challenges in terms of raising production rates of pultrusion lines relate to thermal management, both of the incoming glass and the finished pultruded strands. ProTec's upgrade package includes an additional preheater and optimised die geometry, which accelerates fibre temperature adjustment and ensures high quality fibre impregnation at higher throughput rates, and an additional water batch to increase cooling capacity. ProTec has also made adaptations to the pelletiser to run at the higher output rates and significantly updated control software.

Numerous LFT compounds can be produced on ProTec lines. Any conventional thermoplastic can be used as the matrix, the company says, while reinforcement can be provided by glass, steel, aramid and carbon fibres. Even recycled material



LFTs are very much a niche material with global production amounting to around 490,000 tonnes (less than 1% of total global polymer compound production), according to estimates by Compounding World

Source: AMI/Compounding World

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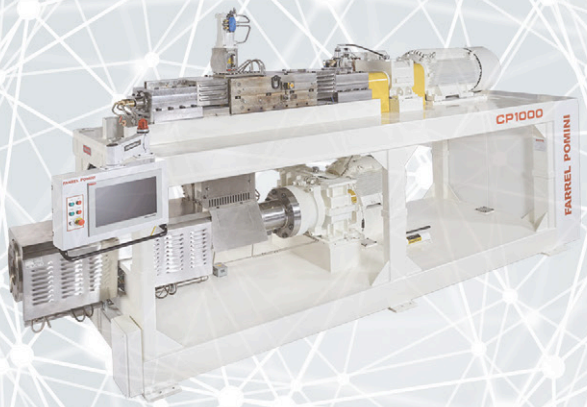

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IMAGE: ARBURG

Above: This Dieffenbacher press is paired up with an Arburg FDC direct LFT compounding system to provide enhanced part production options

and additional fillers can be included.

Chinese compounder Suzhou Hechang Polymeric Materials is one company taking advantage of the versatility of the Protec technology. HCJH predominantly supplies companies in the automotive and domestic appliance industries and has been using its Protec line since August 2017.

ProTec says its ongoing R&D activities ensure continuous development of LFT pellets which it produces from PP, PA, ABS and polyesters (PBT). It offers standard systems with throughputs of up to 1,000 kg/h as well as complete custom installations, which include planning, construction and installation. HCJH opted for this solution for its 64-strand line equipped with a Somos Gramix gravimetric dosing and mixing system, which is also supplied by ProTec.

Taiwan's **Sino-Alloy Machinery** has been working for some time on its own LFT technology. International Representative Donald A Stephens says so far the company has sold one line to a customer in Taiwan, although details are covered by an NDA. "We still plan to also produce our own LFT in our new factory here," Stephens says. "We have our initial pilot line and are currently building two more lines, for a total of three lines producing LFT pellets for commercial sale. They should be ready to start production later this year."

In September last year, **Dieffenbacher** and **Arburg** said they would cooperate to develop new solutions for transfer moulding of hybrid components. The companies intend to combine their expertise in the fields of press systems and automated presses (Dieffenbacher) as well as injection moulding technology and direct LFT compounding (Arburg).

The two companies have worked together already in the area as members of the MoPaHyb research project titled: Modular production plant for heavy-duty hybrid components. Funded by the German Federal Ministry of Education and Research (BMBF), other project participants included Fraunhofer ICT. The project developed and realised a modular production system for hybrid components combining a size 4,600 modular injection unit for fibre direct compounding (FDC) from Arburg with a Dieffenbacher 3,600 tonne vertical press (the equipment is located at the Fraunhofer ICT facility at Pfinztal in Germany. The system is said to make it possible to implement component dimensions and complexities that could not be manufactured previously.

Manfred Reif, Head of the Composites Business Unit at Dieffenbacher, says: "Based on the positive results achieved in the MoPaHyb project, we will in future also be offering Dieffenbacher transfer moulding presses in combination with an Arburg FDC injection unit. Together with our Fiberforge UD tape laying system and the Fibercon consolidation unit, we can offer our customers a strong overall package."

Hitting the road

Ford Motor Company has long applied LFT technology in its vehicles. One of the most recent – and most innovative – applications is the new MegaBox multi-functional luggage compartment. Developed for the latest Puma model by Ford in conjunction with **Röchling Automotive**, it was detailed at AMI's Long Fibre Thermoplastics conference in Dusseldorf in Germany in December last year by Meltem Öztürk and Egemen Erbil from Ford Otosan in Turkey, Matthias Hellriegel from Ford in Germany, and Egon Moos from Röchling.

The MegaBox is a D-LFT component that replaces

IMAGE: FORD MOTOR CO

Right: The flexible MegaBox D-LFT luggage box in the latest Ford Puma cuts weight and offers four times the capacity

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the conventional pressed steel spare wheel well. It is a flexible part that functions as a spare wheel well or to provide additional under-floor storage in versions with tyre repair kits. It can also provide space for a Li-ion battery pack for hybrid models, an integrated urea tank for diesel models, and has sufficient capacity to accommodate an LPG tank.

The part is manufactured using compression insert moulding by Roechling, which allows it to be flexibly configured for different applications. A glass mat reinforced PP GMtex insert is incorporated in all versions to meet crash performance requirements with an additional metal strap used in the spare wheel variant. Integrated moulded-in honeycomb reinforcement adds strength and improves NHV performance. The part is adhesive bonded to the steel car body.

Aside from the flexibility in production, the MegaBox allows a much deeper design than is possible in steel – the Puma's MegaBox is more than 290mm deep compared to 210mm for the equivalent in the company's Fiesta model. The increased design flexibility further improved space utilisation in the structure – the MegaBox provides a usable volume of 80 litres compared to 20 litres on the Fiesta. The Ford engineers said the part delivers a weight saving of around 3kg per vehicle, depending on the variant.

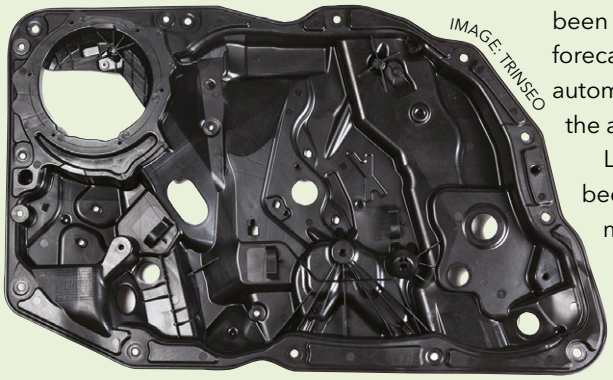
Another Ford application – a lightweight door module carrier developed by Brose Fahrzeugteile and Chinese compounder **Kingfa** for the Ford Focus – demonstrates how LFTs can be applied in combination with new continuous fibre reinforced thermoplastic composites. It was explained at AMI's US Long-Fibre Thermoplastics conference, which took place in Detroit in March last year, by Dr Feina Cao, Research and Development Manager with Kingfa in the US. ›

A market dominated by automotive

The automotive industry is by far the biggest consumer of LFTs and the vast majority of these applications (more than 90%) are PP-based, according to Sylvia Tabero, Senior Consultant with *Compounding World* publisher AMI and one of the company's specialists in long fibre reinforced polypropylene compounds.

The prime reason for this automotive dominance is the ability of the materials to combine high strength and low weight together with design freedom, which allows them to provide an interesting alternative to metal-based solutions. The automotive industry's predictable (at least in the past) and large production runs have also helped make it easier to justify the up-front development costs, Tabero says.

Even so, the use of LFTs varies considerably among manufacturers and models. The average amount of LFT in a car from some major European OEMs amounts to more than 6kg, but stands at less than 1kg for one leading Japanese OEM. Some OEMs use LFTs widely in frontend carriers, while others don't use it at all. Tabero says the reasons for this are numerous, ranging from preferences of engineering designers at OEMs and Tier Ones, through to supply chain ownership and logistics. Apart from front-end carriers, LFTs are also used in tailgates/lift gates, instrument panel carriers, door modules, and under the hood.



Door modules are a typical automotive LFT application. This example is made using Trinseo's Enlite PP LFT

Tabero says it is not clear at the current time how the development of electric vehicles (EVs) will affect the use of LFTs. They may not be used so much in front ends, for example, as the radiators that they carry are no longer there, but they could be an important solution for protecting batteries. In any case, the global growth in LFTs has been exceeding 6%/yr and it is forecast to continue to outpace the automotive market through increasing the average kg per vehicle.

LFT market development has been largely dominated by materials producers, such as the likes of Celanese and SABIC, but compounders such as China-based Kingfa are also significant. It established its first production lines in 2004 and now has the largest LFT capacity in China, with products being used in components at many major automotive and also electronics OEMs. Kingfa makes LFTs based on PP as well as polyamide and has projects running in LFT-TPU and LFT-PPS. While it has compounding operations in Germany and in the US it does not produce LFTs at these locations.

■ AMI's most recent analysis of the LFT market – Long Fibre Polypropylene Compounds, The Global Market – was published in late 2017 and provided data on market size and growth rates, LFT-PP's positioning relative to competing materials, and the current state of LFT technology.

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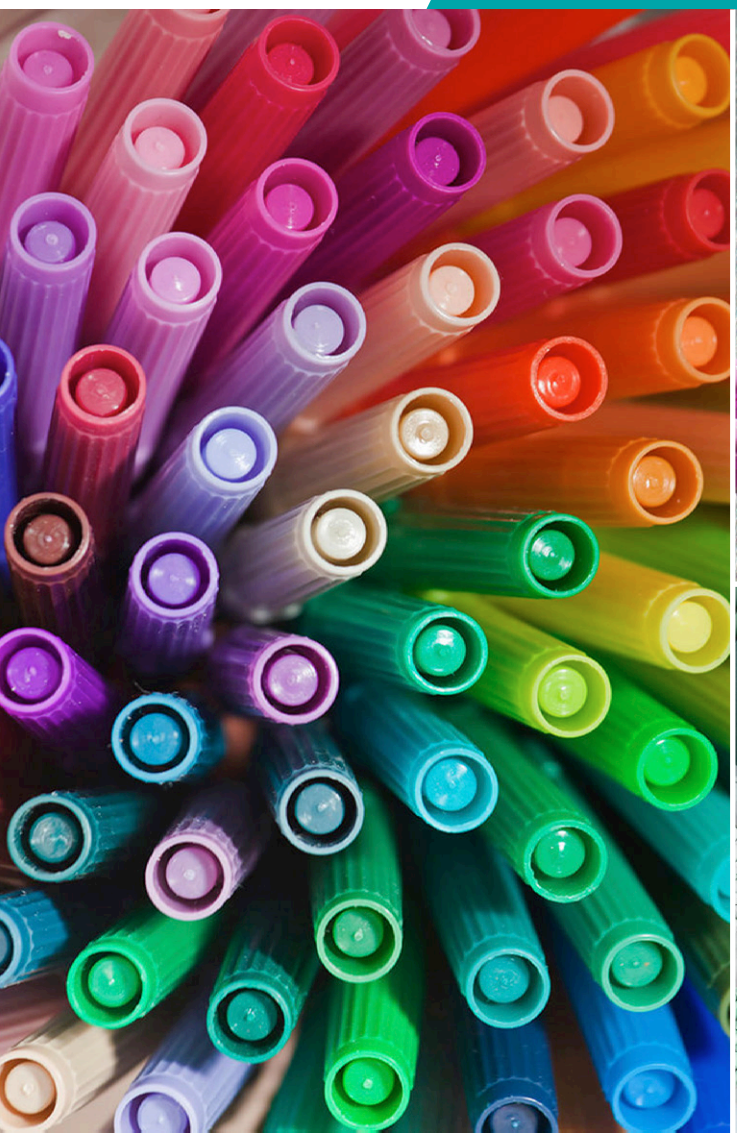

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IMAGE: KINGFA

Right: Detail from a Ford Focus door carrier panel showing how ribbing in LFT-PP is over-moulded onto a continuous fibre reinforced PP sheet

Kingfa is a major producer of LFTs, but the company is not putting all of its eggs in one basket. Its subsidiary Guangzhou Kingfa Carbon Fiber Materials Development Co worked closely with Brose to develop a KingPly continuous fibre reinforced sheet material for mass production of the lightweight door module carrier. Replacing a conventional 30% glass reinforced LFT-PP component, the new design realised a 35% weight saving compared with no compromise in performance. According to Cao, this translates to a saving of more than 1kg per car.

The new carrier combines the Kingpla sheet with an LFT. It is a one step process that combines forming of the thermoplastics composite sheet with injection moulding of the overmoulded rib structure in the same tool.

Development cycles

One of the most visually striking of new applications in LFTs – and a rare example of a non-PP development is an electric-bike with injection moulded composite frame and wheels. Monaco-based Stajvelo selected **Solvay**'s long-fibre Xencor polyarylamide (PARA) compound based on its ability to meet stringent structural, mechanical, and aesthetic requirements.

Solvay says the Xencor PARA LFT significantly extends the performance of its Ixef PARA compounds. The company's Global LFT Manager Eric Martin said at K2019 the new material was evidence of the considerable progress it has made in integrating the LFT technology it acquired through the purchase of EPIC Polymers back in 2015 with its pre-existing high performance polymers (a Ryton grade is in development).

The frame and wheels of the Stajvelo e-bike together weigh just 9kg. Martin said that the Xencor Para LFT material retains the very high quality surface finish that characterises the company's standard IXEF polyarylamide – the cycle parts only required degreasing before paint application.

Below: PolyOne solved an EMI issue for an EV connector by offering a PA-based LFT containing long nickel-coated carbon fibre

IMAGE: POLYONE/GETTY IMAGES

A further example of novel LFT application comes from **PolyOne**, with its Surround EMI/RFI Shielding Formulation (a PA66-based compound containing long nickel-coated carbon fibre). It was approached by a global automotive Tier One that was developing the high voltage electrical distribution system for a European OEM's electric vehicle platform and was running into problems with electromagnetic interference (EMI). Engineers pinpointed EMI leakage at the connection point between the high voltage inverter and traction motor.

The existing material used for these connectors was a non-conductive plastic compound, which allowed for snap-in component assembly and was lightweight but gave no EMI protection. The PA66-based Surround shielding compound met the EMI shielding requirements and easily dropped into the existing design with no extra assembly and without adding weight.

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Compounding WORLD

Simulation software aimed at specific applications and equipment promises greater accuracy in compounding modelling. ***Mark Holmes*** *finds out more*

IMAGE: SHUTTERSTOCK

Simulation tools move closer to the process

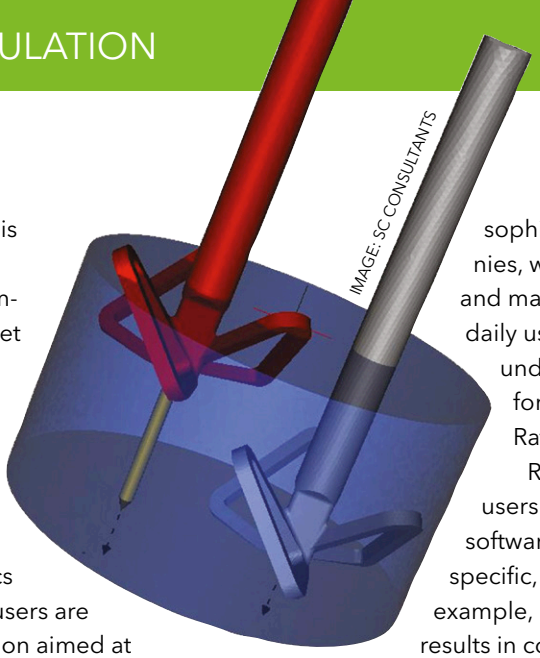
The compounding operation is a complex process with innovations often arrived at through trial-and-error and a heavy reliance on practitioners with years – or decades – of experience and operational know-how. However, the development of process simulation and computer modelling software can now provide a valuable supplementary tool for the plastic compounder.

Replicating the compounding process using such tools and ever more extensive supporting materials databases can now provide accurate methods that can help to shorten the development process and get products into the market more rapidly. Increasingly, programs are being developed to be application and equipment specific, which promises to improve their accuracy, while a shift into the cloud computing environment makes these technology tools even more easily accessible.

Numerical simulation is now a real added-value tool for compounding companies and the wider plastics industry, according to France-based **SC Consultants**. "Indeed, complex processes such as extrusion and mixing are now well described by commercial codes," says Philippe David, Director of the company. "The main advantage of simulation remains the use of theoretical and predictive models, replacing the classic trial and error methods based on an in-depth knowledge of the process. The development of such tools is mainly driven by market trends, from a technological point of view, and by commercial requirements from the industry."

Considered from a technology perspective, simulation is getting closer to the particular process, according to Laurent Ratte, SC Consultants Sales Manager. "Industrial users are looking for solutions for specific applications, as well as ease of use and the relevancy of the results," he says. "Indeed, the results have to be obvious to companies, with process engineers needing to connect with what they observe on the machine. This has led to a totally new approach to marketing

Main image: Compounding simulation specialists are working to develop systems that are more material and equipment specific to ensure results are more accurate and more quickly achieved



Right: SC Consultants developed XimeX-ASAP to quantify efficiency of specific mixers

different software models. This includes highly generic CFD (Computational Fluids Dynamics) software, where the market is for specific applications aimed at simulation of a dedicated installation or piece of equipment."

Specifically plastics

For applications in the plastics industry, he says this means users are looking for a numerical solution aimed at simulation of their own specific mixers or extruders. "In order to meet these requirements, SC Consultants has developed the XimeX-ASAP (Adjusted Software for Advanced Process) application software. ASAP is designed for a single application fully dedicated to one piece of equipment, with pre-defined dimensions, geometry and tools. This way, the engineer only focuses on the material application rather than numerical layers of code. Such an approach brings greater flexibility and helps save time in the process analysis."

Users also gain from the shift from local to cloud computing, according to Ratte.

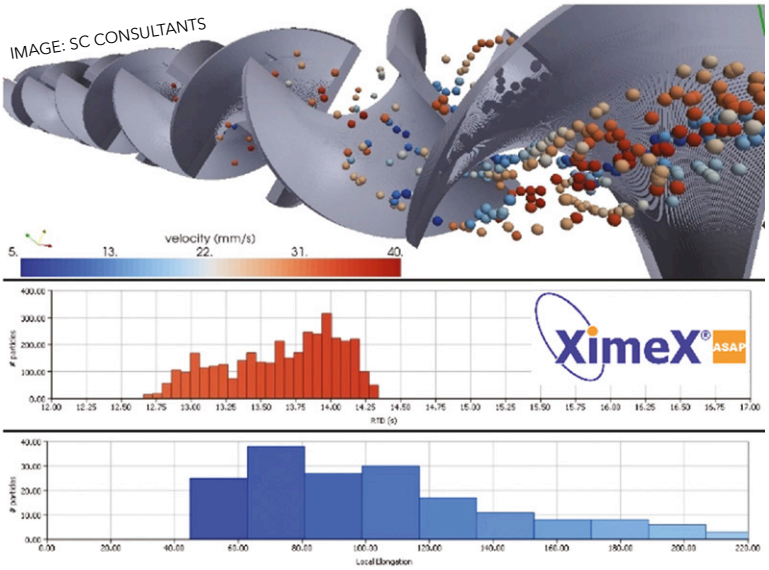
"Numerical simulation also tends to be more flexible and mobile within the cloud computational environment. Hardware, software and licences are dematerialised in the cloud, meaning that they are accessible from anywhere," he says.

However, the move to the cloud does not come without its own specific demands on simulation software developers and users. "Cloud computation is a real challenge as it requires access to more sophisticated tools for companies, while ensuring ease of use and making them accessible for daily use. This market request underlines the growing need for simulation expertise," says Ratte.

Requests from industrial users for process simulation software can also be highly specific, according to David. "For example, recycling plastics often results in complex transformation of materials," he explains. "The need to simulate reactive extrusion or the need to include other specific pieces of equipment, such as screen packs, filters and particular OEM elements, are also new options to be considered and integrated into numerical models."

David says that materials with complex behaviour and formulations are moving the same way. He says new models required to simulate material and mixing laws are always based on developments needed to answer requests from industry, such as the requirement to model more technical materials with increasingly complex compositions containing, for example, natural or mineral fibres, liquid additives or fillers at high addition ratios.

"SC Consultants individually analyses all these requirements and progressively integrates them into our simulation software," he says. "For example, new analytical laws are developed on demand for describing the behaviour of complex materials and blends."



Above: The ability to focus only on the material application in XimeXASAP rather than numerical layers of code means greater simulation flexibility and time savings

Mixing capabilities

David says the company is working continually to improve the methodology in its software to introduce greater accuracy with regard to mixing equipment capabilities. "This is particularly the case with XimeX-ASAP [Adjusted Software for Advanced Process], where we can couple unstationary flow with particle tracking to quantify the efficiency of a given mixer – batch, planetary, continuous or static. Simulation software are definitely valuable tools that can speed up process set up and optimisation, while permitting users to reach the right balance between productivity and final product quality," he says.

In addition to XimeX-ASAP, SC Consultants also offers the Ludovic and XimeX-TSE simulation software, which are dedicated to the co-rotating twin screw extrusion (TSE) process. Ludovic software handles all the twin screw extrusion process parameters for a simulation, including

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geometry and screw design, material characteristics and process conditions. Results deal with material behaviour all along the process and the energy input by the twin screw extruder. It offers automatic Design of Experiments (DoE) tools that provide a process map for the requested process parameters, materials and the chosen screw profile. Outcomes include thermo-mechanical results, such as temperature, pressure, viscosity and filling ratio along the screw profile, as well as detailed energy balance of the process and residence time analysis.

Based on 3D FEM technology, XimeX-TSE provides analysis of the extrusion process itself, particularly in the mixing areas of the twin-screw extruder. In addition to CFD analysis, XimeX-TSE offers particle analysis aimed at quantifying the mixing efficiency for any given configuration, including elongation, erosion and breakage of fibres and particles.

Faster CFD simulation

Germany-based **IANUS Simulation** has developed a system for fast and informative 3D CFD flow simulation in extrusion dies and screws. The company says that, compared to costly experimental investigations, a 3D CFD flow simulation can be implemented quickly and allows detailed insight into the process.

Most importantly, this allows process optimisation in the very early stages of development. The company says that problems that can be quickly identified in this way include dead zones, hotspots, turbulences, high dwell times and inefficient design.

The 3D CFD simulations offered by IANUS Simulation not only optimise dies but also enable screws to be designed and configured optimally in both single and twin screw machines. Simulations can identify temperature peaks, energy input or the shear distribution of the most diverse screws. This allows determination of the optimal transition into the die, a comparison of the material stress and optimal screw design.

The specifically-generated code Extrud3DPro is based on 3D FEM (FeatFlow). This enables the CFD flow simulation to be depicted in 3D and at high resolution. Other benefits of the approach include no trial-and-error or quick calculations, as well as easy handling without any initial training. No additional personnel and material costs are required, which the company says means low investment risk and quick amortisation. The system also offers higher product and process quality, it says.

It is now around one year since US-headquartered engineering simulation software specialist **ANSYS** acquired **Granta Design**, a UK-based provider of materials information technology originally spun out of Cambridge University. The acquisition expanded its portfolio in this area, providing access to material intelligence and data that is critical to successful engineering simulations. ANSYS says Granta will continue its open ecosystem, allowing it to integrate with a wide range of leading product lifecycle management, CAD and computer-aided engineering solutions.

Ansys provides a full range of engineering simulation tools, including its Polyflow computational fluid dynamics solution. This uses a mesh superimposition technique to allow detailed 3D modelling of behaviour in a broad range of applications, including dies and single and twin screw extruders.

Granta Design's main products are the Granta MI enterprise materials information management system and CES Selector, which enables users to explore the impact that different materials have on the behaviour of their products. The company also develops CES EduPack, a teaching resource for materials topics in engineering, science, processing and design which is used by more than 1,000 universities worldwide.

Engineering materials

"With materials engineering becoming an increasingly important aspect of product development, our customers require high quality and comprehensive materials information for accurate simulation results. Integrating Granta's solutions into the ANSYS portfolio will provide a seamless user experience – and enable our customers to innovate like never before," says Shane Emswiler, ANSYS Vice President and General Manager.

ANSYS Granta has already released a new product providing fast-start access to its materials data management technology for design and simulation teams within the ANSYS 2020 R1 release of its engineering simulation. ANSYS Granta MI Pro is a new fast-start materials data management solution that draws upon the technology used in the pre-existing Granta MI Enterprise, which supports enterprise-wide management of materials information at hundreds of major engineering enterprises globally.

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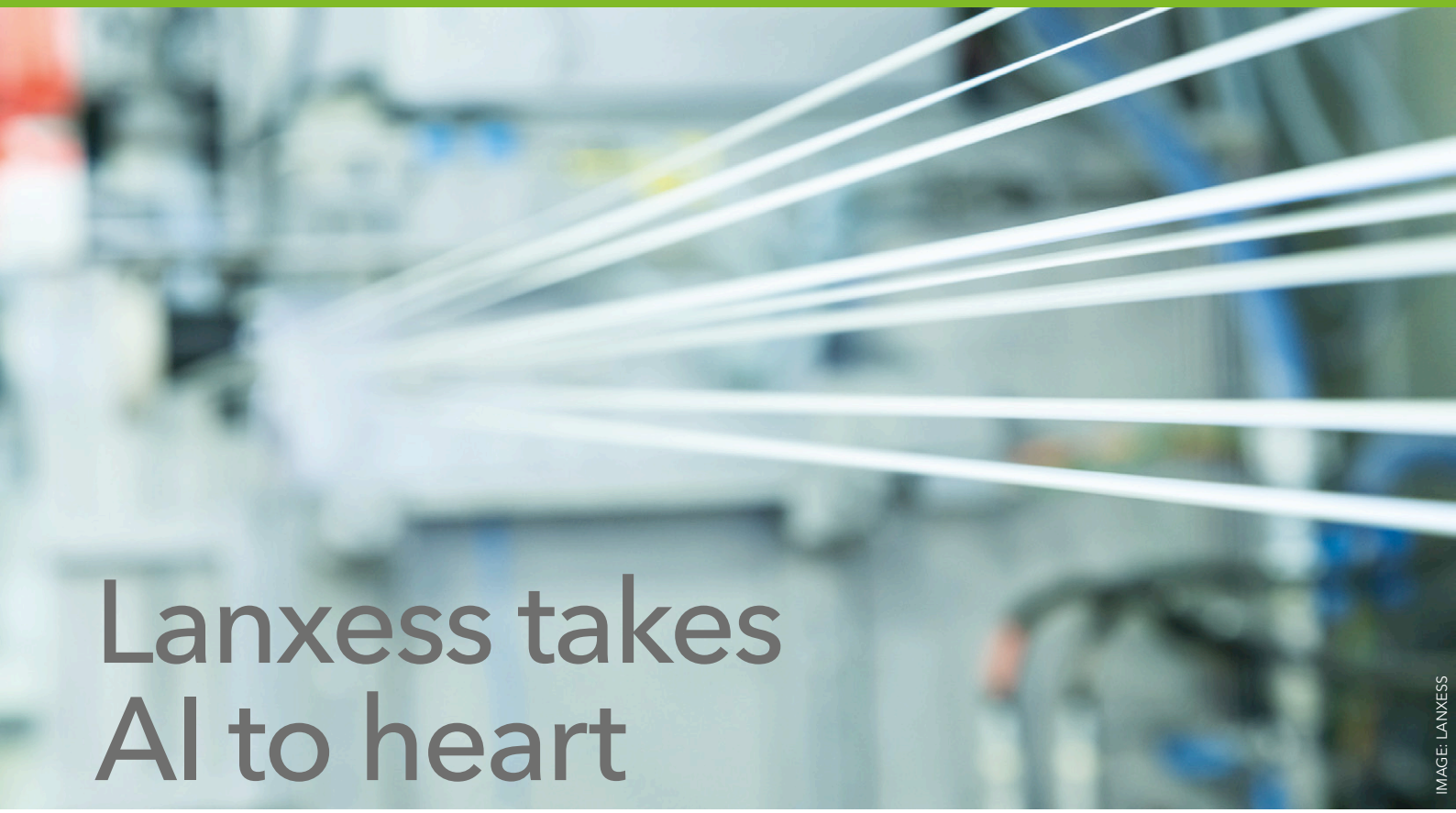


Lanxess takes AI to heart

IMAGE: LANXESS

Lanxess sees Artificial Intelligence (AI) as the enabler to exploit its material data and speed product development. Chris Smith learns about the company's first experiences and its plans for compound development

Developing polymers and compounds is no simple task, with multi-component formulations and complex interactions introducing an element of art alongside basic chemical understanding. Since 2017, Lanxess has been looking to the use of digital tools – and most specifically Artificial Intelligence (AI) technology – to allow it to make better use of its accumulat ed knowledge to speed up new material developments.

The company has been working with Citrine Informatics, a US-based leader in application of data-driven development methods for the chemicals industry. Co-founder and CEO Greg Mulholland explained to *Compounding World* at K2019 that the company's aim is to use AI and data tools to exploit the client's learned experience to bring product to market faster.

"Innovation is becoming more and more important in the chemical industry. You are defined by how fast you can move," he said. "It used to be 20 years or 15 years. Now every auto maker or product maker wants a material by next quarter or next year. If you can respond in two or four or six months, your customer will buy from you and not your competitor."

Mulholland says the reason that major chemical companies such as Lanxess have reached the position they have in the market is the store of data they have built up. The challenge is that, while digital technologies make that accumulated data more available, it is difficult to manage; consistency can be variable and the volume is too great to be manually managed yet too small to apply conventional AI techniques to.

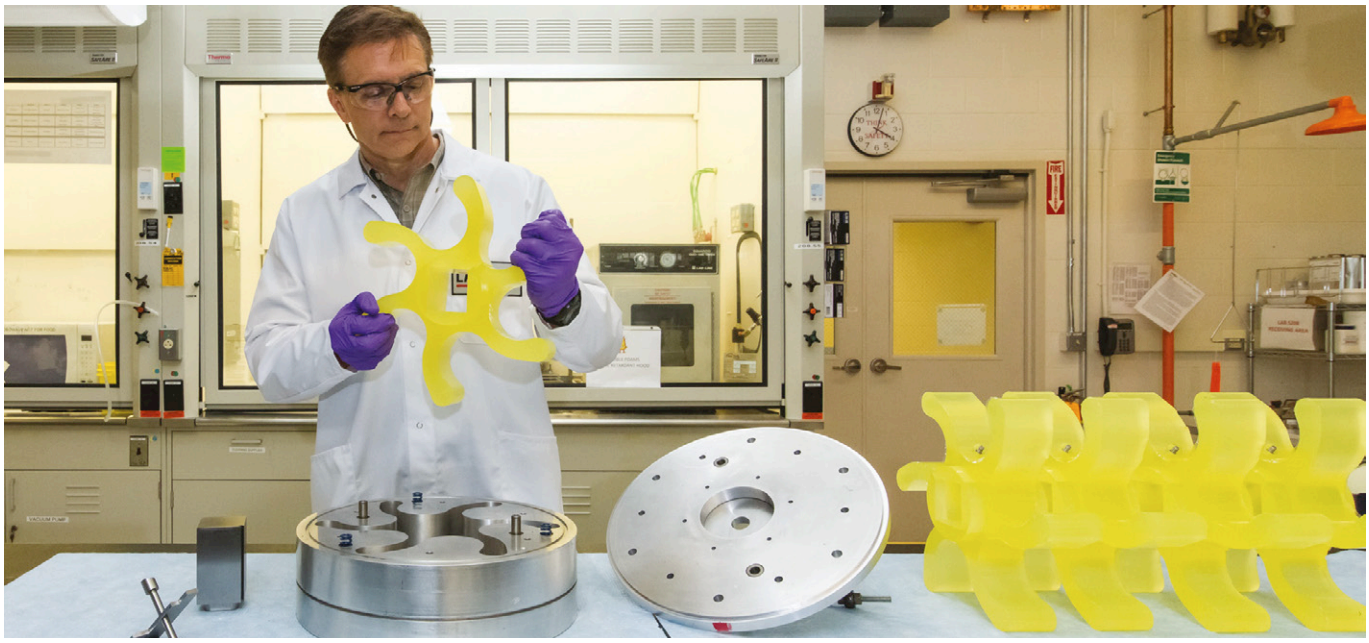
"The volumes of data you need to form a machine learning system are not generally available in the chemicals industry. But you can use machine learning in chemistry even with limited data points because rules exist – this is domain knowledge. This can be integrated into an AI platform," he says. "What does that mean? Well, an adhesive is just a really bad lubricant. So it's about taking lessons learned in one area and applying it in another."

Applying AI

Lanxess has been working with Citrine in several areas and detailed two of them at K2019 – one project aimed at expanding its range of prepolymers for custom polyurethane systems and another to optimise the formulation of reinforcing fibre sizings. ❯

Main image: Fibre sizing is one of the first application areas for AI at Lanxess. It is the starting point for its use in other areas, including compound development

IMAGE: LANXESS



Above: AI has shown positive results" in development of PU prepolymers at the Lanxess R&D facility at Naugatuck in the US

According to Dr Markus Eckart, Senior Vice President and the Head of Urethanes Systems BU at Lanxess, the prepolymer project was initially thought to be ideal for the application of AI. The company had total control of the ingredients in the system and, what they considered to be, a large amount of relevant data. Citrine determined otherwise.

"They said we did not have enough data. And we learned we would never have enough data to be able to just use an algorithm. But we could combine our data with expert knowledge – domain knowledge – to make a new machine," Eckart said.

The first attempts revealed many gaps in the company's data. Eckart said for any formulation it would be typical to have around 20 potential data sets but only five or so would be complete. The only way to speed up the decision making process was to fill those gaps. "Filling the gaps does not mean going back and measuring but using calculation tools to get working data," he explained.

The gap filling work entailed linking existing empirical measurement data with knowledge from the company's process experts and then applying a "chemistry-aware" algorithm to calculate additional measurement values. Only a few real-life measurements were required to verify this new working data.

"In just two months, positive results were being seen, Eckart said. The next step is to see how reliably optimal formulations can be predicted to meet customer-specific product requirements. "If the next tests are successful, we will be able to fulfill customer requests even more quickly and effectively. Our existing knowledge of formulations will be enhanced by AI-assisted formulation design – in other words, systems that are not yet part of our portfolio but for which artificial intelligence will enable us to know instantly whether we can manufacture them and how."

Sizing up

Similar potential benefits have also been seen in glass fibre sizing development. The fibre sizing is critical in achieving optimal interaction between the glass fibre and the resin matrix, so determining the ultimate performance of a reinforced compound. "We expect AI to cut the development time for optimised formulations by more than half," according to Dr Axel Tuchlenski, Head of Global Product and Application in the Lanxess High Performance Materials business unit.

Tuchlenski describes the fibre sizing project as "The Champions League of AI." However, he says it is just a starting point in what it hopes to achieve using the technology – the long-term aim is to use the company's 30 years of compound development and its collection of more than 100,000 individual recipes to meet the future performance and lead-time needs of customers.

"For example, new mobility is one of our big growth areas for the future. This – Evs – needs a change in material properties. Using AI we can make use of our large material database and make these products faster," he said. "We will use Citrine to find the right recipe to deliver, for example, good fire retardance or electrical properties. Product development and compound development will always need experience – AI will not change that – but the number of experiments will be reduced."

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IMAGE: FRAUNHOFER IVV

Measures can be taken to reduce odours and emissions in both virgin and recycled plastics but the first step in the process is accurate detection and characterisation, writes Mark Holmes

Taking a check on odour

Increasing the use of recycled material in plastic compounds is essential in turning the emerging concept of a circular economy into reality. One of the obstacles to be overcome will be controlling emission and odours emitted from recycled plastic material. Enhanced recycling techniques, collection procedures and new additives are all providing new solutions to this challenge. However, detection and characterisation of specific odour causing substances is also vital in the successful re-use of recycled plastic materials in new compounds.

The Department of Sensory Analytics of the **Fraunhofer IVV** (Fraunhofer Institute for Process Engineering and Packaging) in Germany is a leader in research into emissions and odours in plastics compounds. According to Fraunhofer IVV's Dr Philipp Denk and Bianca Lok, new developments continue to be largely driven by regulation forcing a reduction in plastic waste together with a steadily growing public awareness of environmental pollution. As a result, new recycling strategies have to come into focus, they say.

In terms of sustainability, the recently introduced *European Strategy for Plastics in a Circular Economy* addresses not only the increase in the percentage of recycled plastic packaging but also the quality of obtained recyclates necessary to meet the quality requirements for both industrial production processes as well as legal demands. As European plastic converting companies have stated that inadequate odour quality is one of the main problems for recyclate applications, improvements in odour is essential to ensure future applications for recycled plastic material and acquiring new markets.

Main image: The need to use more recycled material is making identification and management of odour a top priority

Identifying challenges

A survey – *Polymer Comply Europe, Usage of recycled plastics materials by plastics converters in Europe* – was carried out by the European plastics converters association EuPC in 2018 where 376 plastic converting companies identified impediments to using recycled plastics. Next to the poor reproducibility of process-relevant properties and insufficient mechanical properties, sensory-related problems were of central importance. In particular, the unwanted smell of the recyclates, as well as the off-odour of finished goods, was listed

IMAGE: FRAUNHOFER IVV

Above: Fraunhofer assembles panels of trained "sniffers" to evaluate odours in a standardised way

as discouraging companies from using recycled plastics. Additionally, emissions from recyclate during subsequent industrial processing raised concerns regarding the health and safety of employees.

Previous studies of the research group at Fraunhofer IVV, carried out by Miriam Strangl, revealed that polyolefin packaging waste of post-consumer origin and its corresponding recyclates exhibit severe contamination by odorous substances. The studies said this needed to be addressed to enable a future circular economy for plastic packaging.

Development of methods to effectively remove odorous contaminants is a priority, according to Fraunhofer, and an important step in achieving that is identifying the chemical structures of the odorous compounds. This enables deeper insight into physicochemical properties, as well as sensory evaluation of specimen materials, in order to characterise the odorous compounds. Since potent odour-active compounds are often only detectable at trace levels, characterisation of causative odorants requires analytical approaches with high selectivity, as well as high sensitivity.

Right: Fraunhofer's solvent assisted flavour extraction (SAFE) technique can be used to isolate volatile components

Sensitive selection

This combination of selectivity and sensitivity is of particular importance in the field of plastics because odorous target analytes often coelute with other dominating, yet odourless, polymer-specific volatiles. The usually performed screenings on major volatile organic compounds (VOCs) using gas chromatography-mass spectrometry (GC-MS) can not provide detailed information on causative odorants and their corresponding chemical structure. To overcome this obstacle, researchers in the Department of Sensory Analytics at Fraunhofer IVV combine sensory evaluations performed by a trained human panel with comprehensive instrumental olfactometric analyses. In terms of the human sensory methods, the panel is trained to evaluate odour on a standardised level (there is currently no norm allowing a standardised evaluation of perceived smell).

For the plastics recycling sector, the ultimate goal is production of high odour quality recyclates, says Fraunhofer IVV. This has already been achieved in terms of the latest super-clean recycling processes for PET bottles. With regard to polyolefins, high and low-density polyethylene (LDPE/HDPE) and polypropylene (PP) are widely used for food packaging and also for packaging of various consumer goods. In contrast to PET bottles, however, which are commonly directed to a separate mono-stream collection system, polyolefin and other collected plastic packaging waste is typically more contaminated with food or other residue materials. This results in a greater contamination of plastic with odour-active substances.

Post-consumer odours

The Department of Sensory Analytics of the Fraunhofer IVV, together with the FAU Erlangen, has now investigated the smell properties and odorant composition of different post-consumer recyclates in a number of studies. Earlier work evaluated odour removal strategies for recycled HDPE using a modified recycling process and disclosed odorant sources. However, because LDPE also plays a major role in various packaging applications, the latest study focused on post-

IMAGE: FRAUNHOFER IVV

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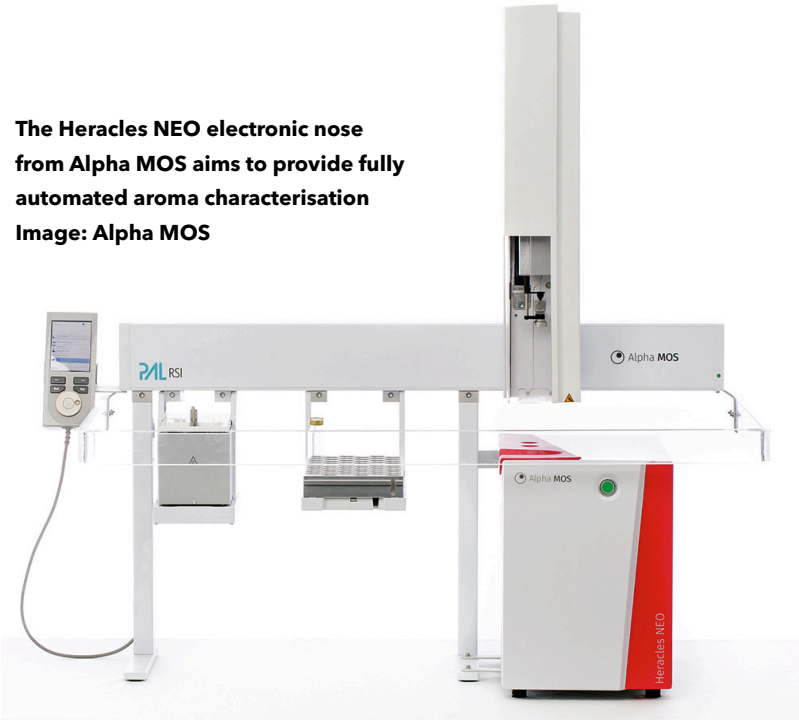

The Heracles NEO electronic nose from Alpha MOS aims to provide fully automated aroma characterisation Image: Alpha MOS

consumer LDPE bags.

Sample material for the LDPE study originated from a variety of collection systems to determine the possible effects of a collection strategy on the odour profile of the LDPE waste. To this end, the odorant composition of LDPE bags collected in a separate plastic fraction were compared to LDPE bags originating from a non-separated collection comprised of all kinds of domestic waste. Information obtained from the performed analyses are essential to develop future odour reduction strategies and so broaden application of post-consumer recycled plastics.

Sensory analysis

Comprehensive sensory analyses, as well as instrumental analyses such as two-dimensional gas chromatography-mass spectrometry/olfactometry (2D-GC-MS/O), enabled the structural elucidation of more than 60 odour active substances in the LDPE bags. Sensory analyses performed by a group of trained panellists revealed that the type of collection system had a noteworthy effect not only on the overall odour but also on the odour profile of the corresponding waste material.

It was found that cheesy and faecal smelling odorants and short chain carboxylic acids, both commonly representing typical metabolites of microorganisms, showed higher intensity ratings in the non-separated waste. This can be explained by bioconversion of organic waste being more abundant in the mixed waste. However, the smell of the waste separated at source was dominated by odorants described as earthy and mouldy. The pre-sorted waste also displayed a significantly lower overall odour intensity. The results suggest that pre-sorting of plastic packaging waste might represent a first and fundamental step to odour-optimised post-consumer recycled polymers.

In addition to the influence of the different collection systems, Fraunhofer IVV says the study also investigated the effect of hot water washing of corresponding waste material on the odour of post-consumer LDPE bags. It was found that washing the separately collected LDPE waste with clean water at 60°C led to a significant reduction of overall odour and therefore improved sensory properties.

Fraunhofer IVV also takes part in the inter-sector and multidisciplinary research project *Circular Plastics Network for Training (C-PlaNeT)* within the framework of the EU's Horizon 2020 scheme. Around 15 doctoral students in the areas of chemistry, process engineering, sociology and economics from eight European universities, together with 23 non-university partners (including Plastics Europe, Ellen MacArthur Foundation, Dow and Adidas), will take on the challenge of considering the complex topic of the circular economy of plastics from a holistic point of view.

Automating smell

Sensory instrumentation specialist **Alpha MOS** has developed its Heracles NEO electronic nose for aroma characterisations of products in all stages of production. "It is a fully automated system from sampling to data treatment for easy-to-understand results," says Marion Bonnefille, Marketing and Communications Manager at Alpha MOS.

"Up to 200 samples per day can be analysed using our automatic sampling system - all you have to do is insert the selected amount of samples into a flask and place it on the tray," she says. "The products are automatically heated for a few minutes to obtain the aromatic compounds – headspace – before injection into the Heracles NEO aroma analyser. The separation of molecules contained in the aromatic mixture is achieved by ultra-fast gas chromatography in two columns. The nature and odour characteristics of these molecules can then be investigated with AroChemBase software module. The Heracles NEO's software provides an easy-to-use quality control tool with a pass/fail result display."

The Heracles aroma analyser was recently used to investigate off-flavours of caps for olive oil bottles. In this project, six samples were analysed with three batches that conformed and three that were out-of-specification. Chromatographs were obtained after analysis of the whole caps and the results displayed on statistical charts to quickly and easily make conclusions about the production quality.

The most discriminating volatile compounds are

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highlighted on the aroma map (Figure 1) and it was observed that many new compounds appeared in some batches, making them non-compliant. Those molecules were identified using the AroChemBase software, showing that alkanes such as decane, nonane and tetradecane isomers were present. Analysis was undertaken on both the plastic and aluminium parts of the caps to understand where the non-conformity was emanating from. The results confirmed that the perceived odour problems were due to the plastic insert and not to the aluminium part of the cap. Quality control charts (Figure 2) were also plotted to separate conforming and non-conforming production samples.

Trace organics test equipment maker **Markes International** has made a number of

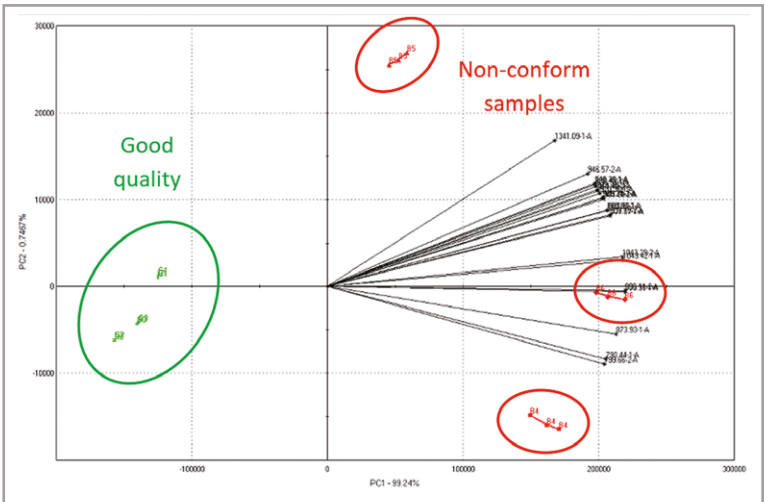

Figure 1: A Heracles NEO aroma map based on principal component analysis (PCA) of a plastic-lined aluminium olive oil closure showing selected discriminating volatile compounds
Source: Alpha MOS

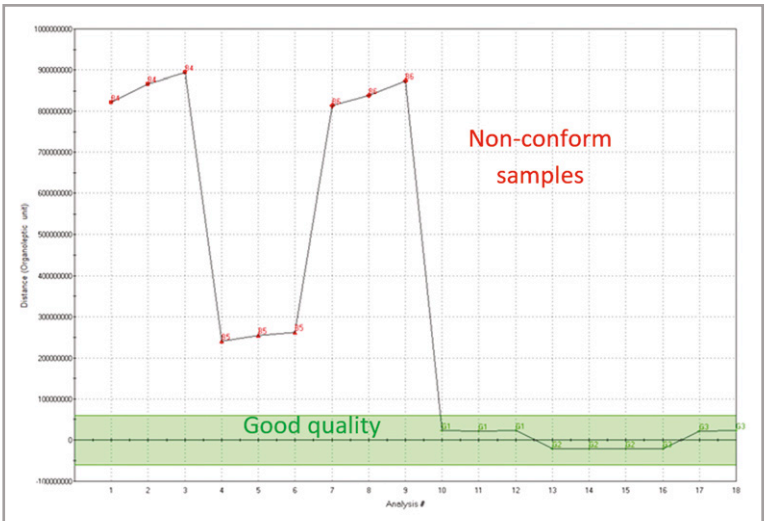

Figure 2. A quality control chart for plastic-lined aluminium olive oil closures produced on a Heracles NEO analysis system using discriminating volatile compounds
Source: Alpha MOS

improvements to its xr series of thermal desorbers for analysis of volatile and semi-volatile organic compounds (VOCs and SVOCs). The company says that these further extend the capabilities of its fully automated TD100-xr thermal desorber and of all the modular systems based on its modular UNITY-xr platform – which include Air Server-xr, CIA Advantage-xr, Kori-xr and ULTRA-xr units.

Stacked samples

Markes says a key feature of the new instruments is 'sample stacking' – the ability to pre-concentrate multiple tube, canister or on-line samples on the same focusing trap before its desorption to the gas chromatograph. This increases the overall analytical sensitivity and usability, allowing the user to combine mixtures of otherwise incompatible standards for analysis in a single run.

"Our customers, whether sampling from tubes, canisters or on-line, are constantly on the look-out for ways to reduce detection limits while at the same time keeping cycle times to a minimum," says Dr Massimo Santoro, Business Unit Director at Markes International. "The new sample stacking capability of our xr systems allows them to do just that, and so get the best out of their TD system."

In addition to sample stacking, a range of features helps to streamline routine instrument use. An automated alert indicates when routine maintenance is needed, helping reduce instrument downtime and to keep the system performing at its best, according to the company.

Additional diagnostic features of the new equipment include intelligent, automated leak pinpointing for faster troubleshooting, and remote checking of on-line instruments.

For analysts routinely running standard methods, and especially for new users, the enhanced systems are said to save set-up time and speed up user familiarisation by offering pre-loaded instrument parameters for a variety of commonly-adopted methods. These include the US EPA TO 15 and TO 17 methods for canister and tube-based sampling, respectively, as well as the PAMS protocol for on-line sampling of hydrocarbon ozone precursors.

Additive solutions

Identifying and measuring additives is part of the battle – eliminating the other. **Struktol** has developed a number of new additives for odour and VOC reduction that it is targeting at automotive, packaging and recycling applications. Struktol RP 17 is a combination lubricant and odour neutralising agent/mask, which was originally designed to

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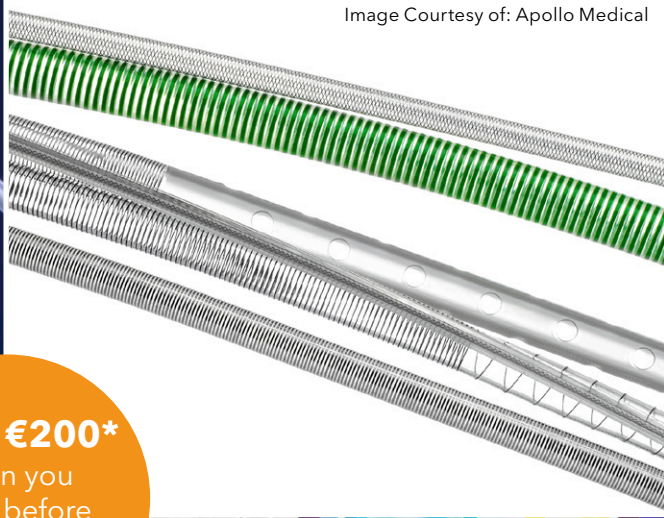

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IMAGE: SANITIZED

Right: Custom formulated antimicrobial masterbatches in production in the Sanitized technical centre in Switzerland

reduce or eliminate process-generated and end-product odours in wood-filled plastic compounds. The company says that the RP 17 additive has also proven successful for use in a variety of polymer resins and compounds that require the multi-functionality of lubrication, mould release, and odour reduction. It can be used in recycling applications, as well as automotive interior compounds, where odour neutralising or masking is a requirement.

Struktol RP 53 comprises a blend of odour neutralising chemistries and is claimed to be suitable for use with challenging high-odour compounds containing problematic species such as mercaptans, amines and phosphites. The product can be used in a variety of polymer resins but is primarily targeted at polyolefins. It can be used in recycling applications, as well as automotive interior compounds. RP 53 is sanctioned for use by the FDA in a number of applications.

Struktol RP 59 contains odour neutralising and VOC absorbers and is intended for difficult, high-odour and high volatile content compounds. It can be used in a variety of polymer resins but is also primarily targeted at polyolefins. The company says that RP 59 is effective in packaging applications, where it can not only reduce or eliminate odours in the packaging polymer but also absorbs odours coming from the packaged product.

Struktol says all three odour reduction additives work at low loading levels and can be easily incorporated into processes such as compounding, direct extrusion and injection moulding.

Targeting microbes

Microbial activity can be a source of odour, especially in PVC formulations. Antimicrobial additives from Swiss company **Sanitized** can protect flexible and rigid PVC end products from bacterial infestation, growth of algae and mildew, material degradation, biofilms, pink stain and odours caused by microbes. The company says its antimicrobial additive is currently used in flooring, industrial coatings, artificial leather, roof membranes, pool liners and tarpaulins. Sanitized recently announced a strategic sales partnership with US-based **Shawnee Chemical,** which will offer the Sanitized products alongside its own PVC raw materials.

Sanitized has also invested at its technical centre at Burgdorf in Switzerland to support customer-specific development of antimicrobial masterbatches. It says that a custom configured twin screw extruder, installed last year, allows faster development of new masterbatch combinations and manufacture of test amounts of polymers with individual antimicrobial additives. The investment allows selection of the appropriate antimicrobial active ingredients to meet the client's protection goals and for suitability with the relevant processing methods.

The new twin screw extruder processes standard and technical polymers. Masterbatches of low to high-melt polymers can be produced in different formulations and finished compounds can be manufactured for testing and trials. A special feature of the machine is its nozzle plates, which allow direct extrusion of polymer strands and tapes for further examination in the Sanitized microbiology laboratory.

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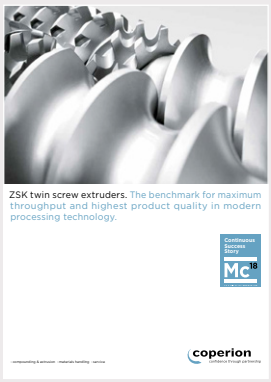

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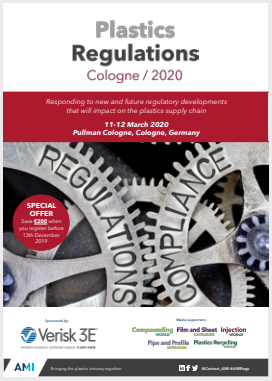

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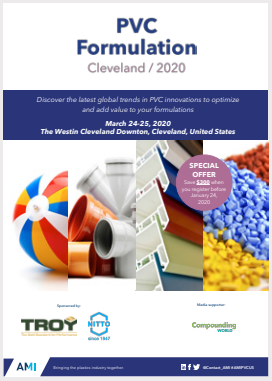

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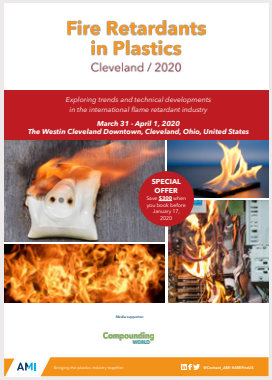

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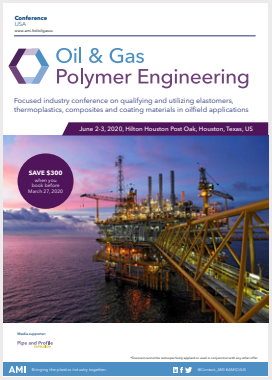

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Find out how the compounding industry in India is benefitting from the developments of all sectors of the plastics industry. Reliable data on over 200 companies producing compounds and masterbatches in India.

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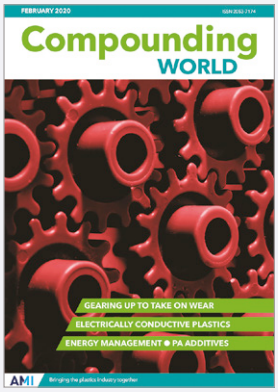
AMI publishes five process-specific FREE plastics industry magazines. Simply click on the cover below to read each magazine. Or download the issue in the relevant Apple or Android app



Compounding World February 2020
The February edition of Compounding World includes features on wear-resistant materials, energy efficiency, electrically conductive plastics and a look at new demands on polyamides from applications in e-mobility and high powered electrical connectors.

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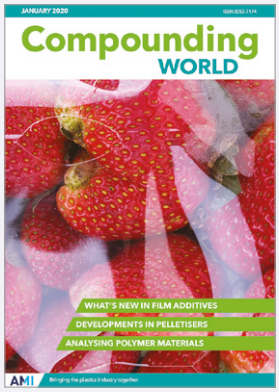

Compounding World January 2020
The first edition of Compounding World in 2020 explored the latest developments in additives for film materials. It also looked at some of the most recent innovations in pelletisers and polymer analysis equipment.

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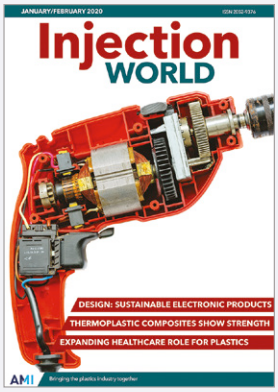

Injection World January/February 2020
Injection World magazine's first issue for 2020 looks at how careful plastics design can make electrical and electronic items more sustainable. It also examines the latest in thermoplastic composites and healthcare polymers.

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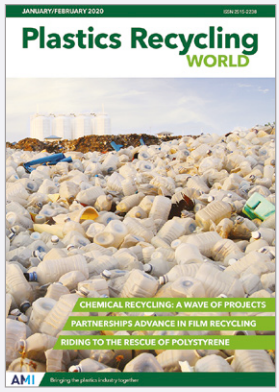

Plastics Recycling World January/February 2020
The January-February of Plastics Recycling World takes a deep dive into chemical recycling, with features on the many technologies being developed for polyolefins and polystyrene. Plus the latest on film recycling technology and projects.

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Pipe and Profile March 2020
The March edition of Pipe and Profile Extrusion magazine looks at the latest ideas in screw production. It also reviews developments in laboratory extruders, computer-based process simulation, and polyolefin applications.

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Film and Sheet January/February 2020
The combined January/February edition of Film and Sheet Extrusion examines the latest developments in film technology, plus new polymer analysis equipment and some innovative medical materials and applications.

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Take out your own FREE subscriptions to any of the magazines. Click on the logos below to simply register on-line.

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

GLOBAL EXHIBITION GUIDE

2020	**24-26 March**	Plast Print Pack, Lagos, Nigeria	www.ppp-nigeria.com
	7-13 May	Interpack, Dusseldorf, Germany	www.interpack.com
	12-14 May	JEC World, Paris, France **NEW DATE**	www.jec-world.events
	19-22 May	Plastpol, Kielce, Poland	www.targikielce.pl
	8-11 June	Argenplas, Buenos Aires, Argentina	www.argenplas.com.ar
	3-6 August	Chinaplas, Shanghai, China **NEW DATE**	www.chinaplasonline.com
	29 Sep-1 Oct	Interplas, Birmingham, UK	www.interplasuk.com
	7-8 October	Compounding World Expo Europe, Essen, Germany	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
	23-26 November	All4Pack, Paris, France	www.all4pack.com
	2-4 December	Plastic Expo, Tokyo, Japan	www.plas.jp/en-gb.html
	5-8 December	Plast Eurasia, Istanbul, Turkey	www.plasteurasia.com/en
	10-12 December	Plast Print Pack West Africa, Accra, Ghana	www.ppp-westafrica.com
2021	**4-7 May**	Plast 2021, Milan, Italy	www.plastonline.org/en
	17-21 May	NPE 2021	www.npe.org

AMI CONFERENCES

31 March-1 April	Fire Retardants in Plastics, Cleveland, OH, USA
28-29 April 2020	Plastic Pipes in Infrastructure, Hamburg, Germany
29-30 April 2020	Performance Polypropylene EU, Cologne, Germany
12-14 May 2020	Polymer Sourcing & Distribution, Hamburg, Germany
1-3 June 2020	Plastic Closure Innovations, Barcelona, Spain
2-3 June 2020	Oil & Gas Polymer Engineering, Houston, TX, USA
2-3 June 2020	Profiles North America, Cleveland, OH, USA
16-17 June 2020	Polymers in Cables USA, Woburn, MA, USA
17-18 June 2020	Medical Tubing EU, Berlin, 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

Conference
USA
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Trends and technical developments in the polyamides industry

May, 5-6 2020, The Dearborn Inn, Marriott Hotel, Dearborn, Detroit, USA

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Performance Polyamides 2020

Five good reasons to attend:

- Learn about the latest technologies to boost the performance of polyamides
- Explore new and emerging market trends, including sustainable solutions, electric vehicles and metal replacement applications
- Benefit from unique insight from polyamide experts and major manufacturers
- Connect with key players from throughout the polyamide supply chain
- Hear from leading compounders about tailoring the properties of polyamides

We are excited to announce the return of AMI's Performance Polyamide USA conference. For its 4th edition, the content-led program provides a timely opportunity to explore the latest advances, new technologies and formulations in resins, additives and compounds for demanding applications in markets such as the automotive, electrical/electronic, medical, consumer goods, construction, and industrial sectors.

This unique forum brings together technical experts from across the supply chain to showcase exclusive insights and new research into how improvements in the properties and processability of polyamides are accelerating the development of this dynamic material for practical end-use applications.

The program covers developments in a wide range of polyamide chemistries and compounds, including high-heat, fiber reinforced, flame-retardant, cross-linked, thermally-conductive, and impact-modified grades. New on the program this year, we explore sustainable and bio solutions and industry's appetite to actively pursue and invest in these materials and technology.

SAVE €300*
when you book before March 20, 2020 using code EB1069

Performance Polyamides 2020 provides a valued platform for the polyamide supply chain to come together, network and explore the latest developments moving the industry forward. Don't miss this opportunity to join your peers including resin producers, compounders, injection molders, product designers, materials specifiers, and end-users.

In addition to the busy two-day program, an exhibition runs alongside the event, providing plenty of networking opportunities during the refreshment breaks, lunches and evening reception.

"Excellent conference, well balanced with great technical and market insights."

Previous attendee

Program

TUESDAY, MAY 5, 2020

8:00 Registration and welcome coffee
9:00 Opening announcements

SESSION 1: MARKET OVERVIEW

9:10 **The state of the plastics industry - analysing global market trends for thermoplastic compounds and opportunities for polyamides**
Mr. Andy Beevers, Director – Events and Magazines, AMI, United Kingdom

SESSION 2: TAILORING POLYAMIDE PROPERTIES

9:40 **New opportunities in nylon stabilization: innovation and sustainability**
Ms. Emilie Meddah, Plastics Market Manager North America, BU Additives, Business Line Performance Additives,
CLARIANT CORPORATION, United States

10:10 **Creating polyamide compounds with permanent anti-static properties**
Dr. Emile Homsi, Research and Technology Manager, CRODA, USA

10:40 Coffee break sponsored by: ALBIS

SESSION 3: ADVANCES IN SUSTAINABLE SOLUTIONS

11:20 **World first PCR-based high-heat PA66 development for turbo-charged auto air induction system**
Mr. Taehwan Kim, Senior Manager, Technical Service & CAE,
WELLMAN ADVANCED MATERIALS LLC,
USA

11:50 **High-performance recycled nylon compounds: the sustainable plastic solution**
Mr. Bruce Lysek, Product Development Manager,
ALBIS PLASTICS CORPORATION, USA

12:20 **Advances in bio-based polyamides for demanding applications in electronics, 3D printing and vehicles**
Speaker to be confirmed

12:50 Lunch

SESSION 4: OPPORTUNITIES FOR CARON-FIBRE-REINFORCED POLYAMIDES

2:20 **Comparative analysis of the performance of various injection-molded carbon-fiber-reinforced nylon compounds**
Mr. Martin Popella, Sales & Business Development Manager,
LEHVOSS NORTH AMERICA, USA

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2:50 **Exploring the effect of sizing on the interfacial and mechanical properties of carbon-fiber-reinforced PA 66 composites**
Mr. Muhammad Iqbal, Research Chemist,
MICHELMAN INC, United States

3:20 **Development of Structural Carbon Fiber-Polyamide 6 Composite Parts for Automotive Applications using Thermo-Stamping Process**
Dr. P. K. Mallick, Proffesor
UNIVERSITY OF MICHIGAN-DEARBORN, USA

3:50 Coffee break

SESSION 5: EXPLORING DEMANDING APPLICATIONS FOR POLYAMIDES

4:30 **Overcoming the challenges for polyamides in demanding electrical and electronic systems**
Mr Erico Spini, Global Marketing Manager,
RADICI HIGH PERFORMANCE POLYMERS, Italy

5:00 **Innovative polyamides delivering fuel economy improvements and sustainability in high end automotive applications**
Mr. Jippe van Ruiten, Advanced Development Manager - ICE Efficiency and Emissions,
DSM ENGINEERING PLASTICS RESEARCH & TECHNOLOGY B.V, USA

5:30 Networking drinks reception

WEDNESDAY, MAY 6, 2020

8:30 Welcome coffee
9:00 Opening announcements

SESSION 6: ADDING FUNCTIONAILITY AND VALUE TO POLYAMIDES

9:10 **New solutions for nylon impact modification**
Dr. Jessica Huang, Associate Research Scientist,
DOW, USA

9:40 **Improved barrier properties in polyamides with more thermally stable mineral filler**
Mr. Dan Berg, Global End Use Manager – Transportation Thermoplastics Additives and Solutions,
BYK USA Inc, USA

10:10 **Novel flame retardant solutions for polyamides**
Mr. Jakub Lison, Technical Manager,
ICL INDUSTRIAL PRODUCTS, USA

10:40 Coffee break

11:20 **Polyamides for 3D printing applications**
Speaker to be confirmed

11:50 **Panel discussion: Exploring the changing OEM requirements, sustainability and exploiting new opportunities for polyamides compounds**

Mr. Maurizio Longhi, Materials Technology Regulatory GSME,
WHIRLPOOL, USA

Mr. Erico Spini, Global Marketing Manager
RADICI HIGH PERFORMANCE POLYMERS, Italy

More panellists to be confirmed

12:50 Closing comments

1:00 Lunch

Agenda sponsored by:

RADICI GROUP
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AMI reserves the right to alter the program without notice. The latest program including any new speakers or changes to schedules can be viewed on our website www.ami.international

Ways to get involved:

ATTEND

Book before March 20, 2020 and save $300 on the full price of $1440, when using discount code. There are additional discounts for group bookings. The registration fee includes attendance at all conference sessions, the networking reception, lunch and coffee breaks on both days and a set of conference proceedings.

SPONSOR

A variety of sponsorship opportunities are available at this conference to help promote your company's products and services to this highly targeted international audience. Contact us for further information.

EXHIBIT

Make it easy to engage with the audience at this busy event with your own highly visible exhibition space. Bring your own display stand and / or banners and use the space to showcase your company's products and services and make a lasting impact. The exhibition runs throughout the conference by the main meeting room and is host to the networking functions.

Space is limited so to avoid disappointment please book for this service as soon as possible.

CONTACT US
Anna Kislingbury
Conference Organizer
T/ +1 610 478 0800
E/ anna.kislingbury@ami.international

Performance Polyamides US

May 5-6, 2020

NETWORKING EVENT

Reception

The networking reception, held on the first evening, offers an excellent opportunity for attendees to meet with speakers and other colleagues. Everyone is invited and admission is included.

CONFERENCE HOTEL & ACCOMMODATION

The Dearborn Inn, Marriott Hotel
20301 Oakwood Boulevard
Dearborn, MI 48124,
USA
T/ +1 313 271 2700

Delegate are responsible for booking their own accommodation. We have negotiated a room rate of $199 per night (tax and wifi included) at the Dearborn Inn, Detroit. Book before April 13, 2020 to secure this rate.

Click HOTEL ACCOMMODATION or go to www.ami.international/events, click on EVENT then Accommodation.

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DELEGATE / EXHIBITOR DETAILS

(If more than one attendee please complete additional form)

Company: _____

_____

Title: Mr/Mrs/Dr/Other: _____

First name: _____

Surname: _____

Job title: _____

Email: _____

Special dietary requirements: _____

_____

Signature:_____Date:_____

BOOKING / INVOICE DETAILS

Company Address: _____

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Country: _____

Tel:_____

Booking contact detail: _____

Company activity: _____

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Invoice address (if different from above): _____

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DELEGATE BOOKING

Includes all conference sessions, a conference pack, networking reception, lunches and coffee breaks

☐ **Delegate** rate Discount code*_____ $1,440.00

Group discounts: book 2 or more delegates and get a group discount, contact the conference organiser for more information

EXHIBITION PACKAGE

Includes entry for one representative from your company, one exhibition space in the networking area and your company profile in the conference pack. Spaces are allocated on a first-come first-served basis and sell quickly.

☐ Exhibition package Discount code*_____ $2,600.00

Total _____

* Please contact conference organizer for available codes

CANCELLATIONS

Delegates can be replaced at any time, free of charge. A charge of $300 will be made on cancellations received by March 6, after this date no refunds will be made. No refunds are available on exhibition spaces or sponsorships.

CONTACT US

Anna Kislingbury, Conference Organizer
T/ +1 610 478 0800
E/ anna.kislingbury@ami.international

AMI

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