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BASF kicks off its \$10bn Chinese verbund project with ETPs and TPU

## BASF breaks ground on China ETP expansion

BASF has officially launched its verbund project at Zhanjiang in China's Guangdong province, the first part of a \$10bn investment project it announced in July 2018. The first plants are now under construction and will produce engineering plastics and TPU for the Chinese and wider Asian markets.

By 2022, BASF said the new engineering plastics compounding plant will supply an additional 60,000 tonnes/year in China, bringing its total capacity in the Asia-Pacific region to 290,000 tonnes. Production is aimed at the automotive, electronics and new energy vehicles industries.

Completion of the Chinese verbund chemical production operation (verbund means interlinked) is due in 2030. Ultimately, the site will be BASF's third largest after its existing locations in Ludwigshafen in Germany and Antwerp in Belgium.

The project will use advanced technologies, including automated packaging and robot guided vehicles. This will make it "a role model for sustainable production contributing to the development of a circular economy in China," according to Dr Martin Brudermüller, Chairman of the Executive Board of BASF. **> www.basf.com** 

### Fainplast ups HFX capacity

Italian compounder Fainplast has started up the first of two new lines for production of its HFX range of halogen-free, flame retardant and cross-linkable polyolefins for the cable industry.

The company said that the second of the two lines is expected to be in production before the end of the year. Together, the new equipment will double its capacity for the HFX product lines.

HFX compounds are produced using Sioplas post-extrusion moisture crosslinking technology. The PE-based materials are said to be suitable for production of halogen-free flame retardant cables for operation at elevated temperatures.

> www.fainplast.com

#### Cabot grows in Indonesia

Cabot has broken ground on its previously announced carbon black capacity expansion project at Cilegon in Indonesia.

Due for completion in 2021, the project will add about 80,000 tonnes/yr of capacity for the South-East Asian market, where demand is said to growing at 4-5% annually.

The move is part of a global expansion and debottlenecking project.

Clariant laser tags without ATO

Working with laser technology company Coherent, Clariant has introduced a new system for moulding and laser-marking TPU ear tags used for identifying cattle and other livestock.

The company has replaced the traditional laser marking formulations based on antimony trioxide (ATO) with a patented additive masterbatch that uses an alternative metalloid chemical plus an enhancing agent. The masterbatch is designed to be used at a dosing level 2-4%. Unmodified TPU is essentially transparent to near-infrared laser light, so an additive is required to produce the carbonisation and/or foaming reactions

required to make a laser mark. ATO is effective and commonly used but is a classified by ECHA as a suspected carcinogen. > www.clariant.com



#### NEWS IN BRIEF...

The European Commission has approved the acquisition of **Solvay**'s European polyamides business, predominantly PA66 polymers and intermediates, by **Domo Chemicals**. The business is being sold to satisfy competition concerns arising under EU Merger Regulations of **BASF**'s purchase, announced in 2017, of Solvay's global Performance Polyamides business.

www.ec.europa.eu

Italian authorities have set a date for a meeting of creditors of mixing machinery manufacturer **Caccia Engineering** for 17 December. Bankruptcy proceedings were initiated against the company, which is based at Samarate in the north of Italy and claims to have delivered 6,000 PVC mixing systems since its formation in 1959, back in August.

http://aescacciagroup.it/

# US start-up sets sights on peak performance

Peak Performance Compounding commenced production at Leominster, Massachussetts, US, offering what it describes as a "service-oriented" option for companies operating in the industrial and medical markets.

Equipped with one 52mm and two 75mm twin screw compounding lines, the newly-formed company will focus on production of pre-coloured specialty compounds including highly filled and radiopaque materials. Services include custom formulating and toll processing.

"Fast turnaround of samples and no minimum order size is our mantra," said Peak Performance Compounding President and co-owner Todd Marchand.

In addition to compounding, Peak also offers pellet and dry powder blending, pellet pulverising and material testing services (the company has its own injection moulding capability and lab-scale tape and film extrusion equipment).

Marchand said it is hoped the company will have ISO 13485/9001:2015 certification in place by Q1 2020. Longer terms plans also include the creation of a humidity and temperaturecontrolled production area

> www.peak-pci.com

# PSG's polymer additives unit acquired by PE firm Jordan

Mid-market private equity firm The Jordan Company has acquired the Polymer Additives division of Polymer Solutions Group (PSG) from Arsenal Capital Partners, another private equity owner. Terms were not disclosed. PSG's Functional Materials division was not part of the deal and remains with Arsenal.

PSG Polymer Additives, formerly known

as Flow Polymers, is based at Cleveland in Ohio and supplies homogenising agents, process aids, dispersions and release agents for the rubber, plastics and engineered wood industries. In the compounding area, it is best known for its SureMix family of process aids.

> www.polymersolutionsgroup.com> www.thejordancompany.com

## Ineos teams up with Viridor in recycling

Ineos and Viridor have joined forces to produce a range of polymers with 50% or more PCR content.

The new materials will be produced from polymer recovered at Viridor's new £65 million recycling plant at Avonmouth, near Bristol in the UK. The facility is said to be the country's largest multi-polymer recycling and reprocessing facility.

"Using our polymer expertise, we will engineer a new range of polymers to incorporate high levels of recycled plastics," said Rob Ingram, CEO of Ineos Olefins & Polymers. "These new materials will meet growing demand for increased levels of recycled content without compromise to product performance and quality." ■ Separately, Ineos has opened a new advanced pilot chemical recycling plant at Rosignano in Italy. It said the aim of the plant is "to develop and produce advanced products which will incorporate plastic waste diverted away from landfill or incineration." The investment is part of the company's ongoing €100m R&D programme. > www.ineos.com

> www.meos.com

> www.viridor.co.uk



Ineos is working with Viridor in the UK to produce recycled polymer grades



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## **Coperion owner wins Milacron**



Hillenbrand CEO and **President Joe Raver** 

US industrial group Hillenbrand, the owner of Coperion, completed its \$1.9bn acquisition of Milacron Holdings last month following approval of its cash and stock offer by Milacron shareholders.

"The completion of the Milacron acquisition represents a pivotal step in our journey to become a world-class global diversified industrial company, and we look forward to realising the benefits of this transformative transaction," said Joe Raver, President and

CEO of Hillenbrand.

Milacron has annual sales of more than \$1bn in plastic technology and processing, with particularly strong market positions in hot runner systems and injection moulding equipment.

Hillenbrand generated revenues of \$1.81bn in the year to end of September 2019. Its Process Equipment Group, which includes Coperion and Rotex, accounted for sales of \$1.27bn and saw growth of 5%. The company is forecasting annualised cost synergies of \$50m within three years as a result of the acquisition.

Hillenbrand said the addition of Milacron to its portfolio will mean "increased scale and meaningful product diversification" and "expanded capabilities across the plastics value chain, including base resins production, compounding, plastics processing and recycling".

Hillenbrand said it is reviewing strategic alternatives for Milacron's Cimcool metal-cutting fluids business.

> www.hillenbrand.com

## ECHA investigation reveals poor SVHC communication

A pilot investigation carried out by the European Chemicals Agency across 15 countries has found the presence of SVHCs (substances of very high concern) in products is not being effectively communicated through the supply chain.

The project inspected 682 articles considered likely to contain SVHCs from 405 companies and found that 84 (12%) contained SVHCs at concentrations above 0.1 wt%. Of the 45 articles where the manufacturer had a duty to communicate SVHC presence along the supply chain, this was only done for five articles.

In addition, the investigators found 37 out of 42 companies failed to provide the name of the substance to recipients of their articles.

"While nearly 90 % of the products do not contain substances of very high concern above 0.1 %, the report clearly shows a failure of communication in the supply chain," said Erwin Annys, Head of ECHA's Support and Enforcement Unit.

IMAGE: SABIC

> www.echa.europa.eu

## **SABIC** makes impact in water

SABIC has added Noryl WM330G to its portfolio of high-performance thermoplastics for water management applications. The 30% glass-reinforced PPE grade, which is produced at the company's site at Bergen-op-Zoom in the Netherlands, is said to be the first in a family of materials featuring proprietary impact-resistant technology.

Key claimed benefits include higher burst pressure and better resistance to fluctuating pressure and creep rupture. SABIC said this will open up opportunities in new applications such as ultrasonic water meters and instant water heaters, IN as well as volumetric water meters, pump housings, control valves and hydro blocks. > www.sabic.com

SABIC's latest PPE for water applications offers better creep performance

#### **NEWS IN BRIEF...**

Switzerland's EMS Group has sold its automotive airbag igniter business -EMS-Patvag - to Hirtenberger of Austria. The company said the business was non-core (accounting for less than 1% of sales) and is in line with its strategy of focusing on high-performance polymers and high-margin specialities.

#### www.ems-group.com

Merck has held a topping out ceremony for its new effect pigments facility at Gernsheim in Germany. The €28m investment will significantly increase its production capacity for silicon dioxide flakes., which are used in its Colourstream and Xirona brands of effect pigments. www.merck.de

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## Free registration opens for Compounding World Expo

Free online visitor registration has opened for this year's biggest European compounding exhibition and its three co-located plastics shows covering extrusion, recycling and testing.

Organised by Compounding World publisher AMI, the Compounding World Expo, Plastics Extrusion World Expo, Plastics Recycling World Expo and Polymer Testing World Expo all take place at Messe Essen in Germany on 3-4 June 2020.

By registering in advance, visitors will gain free admission to all four exhibitions, featuring more than 300 international suppliers, plus free entry to five focused conference theatres hosting technical presentations, educational seminars and debates.

"The event will provide visitors with a great opportunity to meet and compare suppliers from around the world, as well as giving them the chance to learn from business leaders and technical experts in the conference sessions," said Rita Andrews, Head of Exhibitions at AMI.

The expos will feature a wide array of leading manufacturers of compounding, extrusion, recycling, testing



The Compounding World Expo's free conferences are expected to prove popular again in 2020

and analysis equipment, plus suppliers of a huge variety of polymers, additives and related services.

The conference theatres will feature more than 100 expert speakers over the two days, including influential representatives from leading compounders, extruders and recyclers, plus exclusive market presentations from AMI's consultants and editors.

"Our debut compounding and recycling exhibitions in Essen, Germany attracted 184 exhibitors and 4,024 visitors in 2018," said Andy Beevers, AMI's Events Director. "We are confident that our next Essen event in 2020 will build on this success with the addition of two new focused exhibitions and many more exhibitors." The exhibitor line-up already includes a large range of international companies such as Azo, BASF, Biesterfeld, Borealis, Bühler, Buss, Cabot, Clariant, Coperion, Dynisco, Erema, Evonik, ExxonMobil, Farrel Pomini, Fraunhofer, Frontier Lab, Gabriel Chemie, Gneuss, IMCD, JSW, Konica Minolta, KraussMaffei Extrusion, Maag, Mixaco, Mitsui, Montello, Motan Colortronic, NGR,

Nordson, Norner, Omya, Solvay, Starlinger, Veolia and more than 200 additional leading suppliers.

The limited number of remaining booths are being filled on a daily basis. To find out more about exhibiting at any of the expos, visit https://www. ami.international/exhibitions

Essen is readily accessible by car and public transport from major industrial hubs in Germany, Benelux, France and beyond. In addition, it is just 20 minutes' drive from Düsseldorf airport. Making the same journey by S-bahn and U-bahn trains takes under 60 minutes.

To secure your free ticket, which is valid for both days of the event, visit: www.ami.ltd/Register-AMI-Expos

## Challenging times for bioplastic firm Bio-On

The officially-appointed Judicial Director dealing with troubled Italian bioplastics producer Bio-On announced the appointment of Ricarado Casoni as General Manager. He is charged with steering the company through its current difficulties.

The move follows a search and seizure of documents at the Bologna-headquartered company on 24 October by the Italian financial authorities over financial irregularities. These are alleged to include booking of false revenues and fictional licensing agreements.

The investigation led to Bio-On founder and President of the Board of Directors Marco Astorri being placed under house arrest in October and the removal of Vice President Guido Cicognani and Board of Auditors Chairman Gianfranco Capodaglio from their posts.

In November, it was announced that the company, which produces bioplastics based on polyhydroxyalkanoates (PHA), would suspend all payments to employees, suppliers and credit institutions.

According to Reuters, Italian prosecutors opened their investigation into potential market manipulation back in July after allegations of accounting regularities were made by US financial group Quintessential Capital Management. > www.bio-on.it



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#### NEWS IN BRIEF...

Sweden's **Nexam Chemical** has received a €1m order for its Nexamite masterbatch from a leading un-named producer of PET foam. Deliveries will be made during the first eight months of 2020 in Europe and North America. The company also said it was to spend €1m to update its productions locations in Sweden and Scotland. **www.nexamchemical.com** 

Diversified chemicals company **PMC Group** is to buy the organotin specialties product line of **Lanxess** Organometallics. The deal should close by the end of 2019 and covers organotin catalysts, organotin specialities and intermediates. Lanxess will continue to toll manufacture some products. www.pmc-group.com

www.lanxess.com

## Q3 machinery shipments in US down 15% on 2018

US shipments of primary plastics machinery declined by 15.9% year-on-year to \$249m in Q3 2019, according to the Plastics Industry Association's Committee on Equipment Statistics (CES). The figure was also slightly down on Q2 shipments.

The heaviest year-on-year decline was for twin-screw extruders (-29.3%) followed by injection moulding machinery (-15.5%) and single-screw extruders (-5.6%).

"The machinery shipment numbers were in sync with weaker manufacturing activity against the backdrop of an economy that moved sideways," said Dr Perc Pineda, the association's chief economist.

Exports were almost static at \$378.4m. Mexico, Canada, and Germany still





represented the largest markets, with a combined 48% of the total. China, the fourth largest, was 27.6% down on Q2 at \$22.2m.

Machinery imports fell by 0.9% to \$785.7m, thus combining to reduce the plastics machinery trade deficit by 1.7%.

"The challenges and concerns of the business sector of the economy today, and plastics industry is no exception, are largely driven first by external factors - weak global economic growth and ongoing trade disputes - feeding into the US, which is largely an open economy. It is safe to say that it is unlikely that the ongoing trade disputes will be resolved this year," Pineda said.

> www.plasticsindustry.org

## USP opens TPE production plant in Texas

Custom compounder United Soft Plastics (UPS) has opened a 1,860 m<sup>2</sup> facility at Houston in Texas, US, complementing its current operation at Lawrenceville in Georgia.

The new plant will produce the full UPS product portfolio, including traditional SEBS-based TPEs, TPOs and TPUs as well as specialty acrylic-based TPE com-

pounds, and will have a capacity of 5,400 tonnes/yr.

USP Executive Vice-President Benedict Herbst said the investment "represents a strategic market reposi-



tioning which enables USP to move closer to raw material hubs and high-volume customer accounts in Mexico, the Southwest US and also Asia". The additional production

#### Left: Automotive has been a key driver in demand for USP's TPE compounds

capacity at Houston will allow the Georgia location to take on more product development projects, the company said.

The Houston facility is equipped with a KraussMaffei Berstorff twin-screw compounding extrusion system

with a Nordson underwater pelletiser. It also houses advanced testing equipment and a fully equipped materials laboratory.

> www.unitedsoftplastics.com

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#### LAB COMPOUNDERS | MACHINERY

IMAGE: BUSS

Laboratory extruders are an essential element in compound development, saving material and production line time. **Peter Mapleston** reviews the latest developments

## Mixing it up in the lab

The advantages of laboratory-scale compounding are multiple. Sample quantities are many times smaller than would be the case on a production machine so use of materials remains low, which is particularly important with expensive or difficult to obtain materials. For the same reason, the disposal costs for test materials are much lower. And the ongoing production process does not have to be interrupted for tests to be carried out, which saves considerable downtime costs and, of course, associated lost production. The more compact designs and low throughput rates of lab scale equipment also enable test set-ups on laboratory compounders to be adapted more quickly and easily.

The latest laboratory compounding equipment meets a range of needs, in terms both of output levels and also the way the compounding process is carried out. Several new pieces of equipment were on display at K2019 in Dusseldorf in October. This article takes a look at some of them.

The TwinLab-C 20/40, from **Brabender**, is the successor to its KETSE 20/40. It has 20mm diameter screws with an L:D ratio of 40. ID:OD ratio is 1.6. The new unit is manufactured in materials that can withstand high abrasive forces and corrosion, and can be used for processing compounds at

temperatures up to 400°C. It incudes an integrated frequency inverter-controlled motor that runs at speeds of up to 600 or 1200 rpm (there are two versions). The unit boasts four ports on the top and two on the side. It has four electric heating zones and chilled water cooling.

Brabender says the TwinLab-C 20/40 can be used in a wide range of applications, from feasibility studies and material developments in research institutes and industry to analysis of material behaviour during a process and developments in the field of recycling. It is also suitable for quality control and will happily take on very small quantities, for example for production of samples or test specimens. It is suitable for compounding samples based on all sorts of thermoplastics, with or without fillers or additives.

The TwinLab-C 20/40 can be fitted with a wide range of die heads and modular screws. The various feed openings can be flexibly equipped with dosing systems, thermocouples, pressure transducers, liquid/gas pumps or a vacuum pump. Measurements are carried out using web-based MetaBridge software via a touch screen. The software allows multiple users to access the measurement results from different locations and devices. Main image: **Buss is scaling** down its latest Compeo kneader design (shown here in a 55mm version) for laboratory compounding duties. First deliveries of the 44mm model are expected in 2020

#### **MACHINERY** | LAB COMPOUNDERS





#### Above: The TwinLab-C 20/40 from Brabender can be fitted with extensive die and screw options

**Right: Noris** Plastic's ZSC 20 is designed for flexibility in application

User acceptance

Noris Plastic premiered its latest laboratory compounder, the ZSC 20 (also with 20mm screws). "This machine type is characterised by high user acceptance, especially in the development of masterbatches and special compounds," says the company. "Used in industry and universities, compounders of this series are used in research and development as well as in small-scale production."

A special feature claimed for this extruder system is its ability to process a wide variety of materials. "Added to this is the very fast changeover capability which helps to gain quick insights in test and development tasks," Noris says. Different materials depending on forecast wear requirements are available for the processing unit. In addition, a wide range of downstream units and accessories is

ThermoFisher showed a laboratory scale compounding line configured for production of 3Dprinting filaments. Built around its Process11 lab-scale twin screw compounder, the line included a gear pump, die, water bath and winder.

With an output rate of between 20g and 2kg per hour, the 11mm diameter extruder is fully ported and can handle powder and liquid materials as well as standard pellets. An optional inline measurement system is also available, although the melt

IMAGE: THERMO

FISHER SCIENTIFIC

Below: This R&D Line for 3Dprint filament development is based on ThermoFisher's Process11 lab extruder

available.

pump is said to ensure very tight control of filament diameter in standard specification.

"3Dprint is still something that needs to prove its self," says Dirk Leister, Leader Technical Marketing in the company's Material Characterisation Products unit. "But we have customers in universities and in business that want to work with materials that are not commercially available."

Italy's Maris says a priority in the development of its TM20 Hi-Tech twin-screw lab extruder was the ability to accurately and reliably predict scale-up. "The scale up from this type of equipment is not immediate but can be calculated by considering the following: different factors of heat exchange (as a function of the barrels diameter); feeding configuration for powders and liquids," the

> company says. It offers a calculation programme for scale-up escalation.

The TM20 is equipped with 20mm screws and offers an ID:OD ratio of 1.55 and maximum torgue of 47 Nm. The machine features a

modular configuration with key elements such as the control system all integrated into the frame to save space. It is said to be suitable for a broad range of applications, including polymer alloying, reactive extrusion and devolatilising as well as produc-

tion of commodity and engineering plastics compounds and masterbatches.

#### High torque options

NOTIS PLASTIC

Moving up in size, Polimer Technics has introduced high torgue options for its Poex T Series twin screw extruders - which includes the T27, T40, T60, T75, T94 models - to allow better scale-up to production lines. The company says the Poex T27 (which has 27mm diameter screws with an ID:OD ratio of 1.55 up to 1.76, depending on application) has been designed especially as a laboratory compounder for R&D work as well as for optimising new product formulations. It is said to feature

> easy operation and high flexibility in operation, thanks to its modular construction that allows screws and shafts to be changed very quickly.

> > "Due to the fact that it requires only a small area and can easily be moved, the user gets the flexibility of a lab

IMAGE: NORIS PLASTIC

machine which can be adopted for batch production as well as for lab research," says Reha Yelken, Sales and Marketing Director at Polimer Technics. The unit has a maximum drive power of 37kW, providing a screw speed of up to 1200 rpm. Output capacity is between 30 and 100 kg/h, depending on application.

Staying in the same size range, **JSW** showed its TEX25 $\alpha$ III at the show. "The TEX25 $\alpha$ III is an upgrade version, especially in terms of its control system and software, with the advantage of simpler operation via a comfortable touch screen," says Process Engineer Makoto Tojo. "Only two inputs are required - target throughput and screw speed - after which the software automatically and gradually boots the extruder to the set output."

Tojo says one of the reasons for developing the new software was to provide compliance with the latest factory management IT systems. "Remote maintenance out of Japan or our Düsseldorf tech centre, diagnoses as well as predictive maintenance, software updates and process optimisations can also be carried out on the customer's systems via internet," he says.

#### Maxi developments Labtech Engineering

showed a new design of its 26mm twin-screw extruder. This is available in two versions, one with a standard 15kW motor and the



Left: The Poex T27 from Polimer Technics can be used for laboratory and small batch production work

IMAGE: POLIMER TECHNICS

other, the Maxi26Compounder, with a 22kW motor giving screw speeds of 1200 rpm and a maximum output of around 120 kg/hr with highly filled masterbatch. The minimum batch size can be as low as around 1.5 kg, which the company says makes the unit suitable for both small sample batches and small production runs.

In both power variants, the motor and gearbox are fully enclosed behind sliding doors on front and back, with the front door featuring a large window for clear vision of the gearbox and torque



limiter. "With the enclosed motor, the air from the motor cooling fan is entering and escaping at the bottom of the extruder body," says Peter Jurgensen, the company's President. "This ensures that no air is blown over the infeed section of the barrel, preventing build-up

of dust from powders in the compound." He

Left: Labtech's new 26mm unit is offered in standard and Maxi version with a 22kW drive



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## Safer Cables, Safer Living

SILON Compounds Make Better Cables

Right: The FED 26 MTS from Feddem is claimed to offer good scale-up performance also points to the high-gloss stainless steel barrel cover, which has removable sections for each module, making it very easy to add one or several side feeders.

"We also have a brand new 12mm twin which has the unique property that it can be fed with regular pellets," says Jurgensen. This unit, with a modular clamshell barrel, 36 L/D screws and a 2.2kW drive, is suitable for compounding batches as small as 20g or even less, he says. Maximum output is around 4 kg/h.

**Feddem** demonstrated a 26mm twin-screw at the show, too - the FED 26 MTS. This is not a brand new model but was shown equipped with a new ProFlex C100 loss-in-weight feeder from Schenck (an optional addition). The extruder is designed for laboratory work and also for small batch production, with Managing Director Dieter Gross saying it has very good scale-up capability.

The machine on display had all barrel and screw element surfaces coated with a wear and corrosionresistant material. It had two side feeders and one side vacuum degassing unit, but the latter's position also be used for a side feeder if required. The basic unit has 32 L/D screws, but this can be increased to 42 L/D, which also provides room for a further feeder.

Below: Schenck Sales VP Manfred Bruckner changes gear ratios on the company's ProFlex C100 feeder, introduced at K2019 The FED 26 MTS unit uses Feddem's kneading block-free screw, which Gross claims avoids high shear and provides better distributive mixing and more gentle compounding. It also features the company's signature curved die plate (a feature also used on larger Feddem machines), which is said to avoid curling at the edges as the speed profile of the melt across the entire width of the die is much flatter than in flat dies. Gross says this provides big reductions in material losses, in some cases as much as 50%, at start-up.





#### **Precision feeding**

**Schenck**'s ProFlex C100 rounds off the company's ProFlex C system, already well established in the compound and masterbatch industry, and provides smaller feed rates (around 0.1 - 100 l/h). It has the same features as its larger family members, such as a flexible feed hopper with external eight-point agitation, easy dismantling of components for feed rate adoption or cleaning with just one tool, feed rate modification using a range of helixes and screws in two different discharge lengths, integrated gravimetric isolation with optional pressure compensation, and reduction of pulsation at low speeds, thanks to a special discharge geometry.

The integrated quick-change plug-on gearbox between the drive and helix shaft provides six different reduction ratios at a total turn down ratio of 1:5. Just a few component changes are needed to change the ratio between motor frequency and helix rpm or between helix rpm and the agitation speed.

#### Good vibrations

Staying with feeders, **Coperion K-Tron** introduced its K3 family of vibration feeders for dosing of free-flowing materials into the compounder with very high levels of accuracy and consistency. The feeder also has the advantage of low maintenance is also very easy to clean.

R&D engineer Urs Helfenstein says vibration feeders normally have rubber feet or springs to isolate the vibration from the environment but that a disadvantage of this arrangement is that the cushioning system can move in all directions. "If we analyse the movement of the train, we see that it is

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Right: Coperion K-Tron's new K3 vibration feeder provides accuracy and consistency rotating and not moving in parallel only," he says. "This means that you have different material speeds over the tray length. The material height along the feeder is not constant. The disadvantage is that the scale indicates that there is not enough output, so it sends a command to provide a higher amplitude. The feeder is always reacting to these changes in material height, but there is always a delay."

Helfenstein has invented a system that uses pendulums instead of rubber feet or springs. The pendulums can only move in the direction of vibration, so the tray is always moving with a parallel motion. This, he says, provides a constant material height. "There is virtually no delay between setting a command to change output and the output actually changing, yielding an improvement in output accuracy of 35%."

The advanced control system and feeder electronics include internal sensors which measure acceleration, displacement, load, current and temperature at rates of up to 25,000 times per second. The controller then adjusts the vibratory drive signal to maintain clean sinusoidal displacement for optimal mass flow. "Even with the smallest vibrations we still have a constant amplitude," Helfenstein says. This is said to make it possible to use the same feeder for feeding quantities anywhere from 4 to 2000 kg/h, with the same high level of accuracy (another version soon to be launched can dose up to 8 tonnes/h).

The version more appropriate for laboratory

Right: Crosssection of the processing section of the new planetary lab extruder from Entex



MAGE: ENTEX

work offers a range of around 1-500L, or 500g to 250 kg/h with a standard tray. A special tray makes even lower levels possible. The company claims that the flexibility the new system provides can be a big advantage in laboratory applications.

In addition, the feeder is especially gentle on the material, which also manifests itself in the amount of energy the feeder consumes: 25 times less than a screw feeder.

#### Lab alternatives

It's not just twin-screw extruders that come in lab versions. **Entex** showed its L-WE 30 laboratory planetary extruder at K2019. It has an output of between 0.5 and 10 kg/h. As with larger versions, some of which can process as much as 8 t/h, it has a modular construction that allows for spindles of various designs to be used in the planetary sections. There are three cylinder assemblies (one planetary feeding cylinder and two others) with six standard planetary spindles per cylinder. These rotate around a central spindle. Modularity extends to the plug-and-play heating and cooling units, which fit under the table supporting the processing system and provide highly precise temperature control (see Compounding World October 2019).

Buss is preparing a laboratory addition to its latest Compeo series of kneaders. The company says it will feature a 44mm tempered screw shaft and exhibit all of the main features of its larger siblings. This includes a configurable barrel housing with process lengths ranging from 11-25 L/D and the possibility to combine two, three, four and six flight elements, side feeders, an active de-gassing zone, high temperature electric heating system and much more. The base model is currently planned to feature a 70mm single-screw discharge unit, with the option to upgrade to a 35 mm counter-rotating conical twin screw unit. The design of the new machine should be finalised earlier next year, with first deliveries possibly around mid-2020.

"A primary focus of the design is to provide a holistic solution from raw material to finished pellets," says Design & Development Engineer Dino Kudrass. "We want to supply a compact and well-integrated system with flexible dosing equipment that communicates with the kneader control and allows for fast and comfortable refills. The same goes for the strand or underwater pelletiser system, which should not be merely

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'added' to the compounder but shall be part of the design from early concept phase."

Communication and data acquisition are also important fields of progress within the development. "The challenge here is not to simply measure and log as much data as possible, but to approach the design from the direction of what information is relevant and then implement the necessary technology," says Kudrass. "For the Compeo 44 we intend to implement the option of spectroscopic analysis of the compound as a form of inline process monitoring. This will provide feedback of variables such as degradation, dispersion, dosage elevations, colour change and compound homogeneity."

The Buss view is that a lab compounder should perform well in two, somewhat opposing, ways, Kudrass says. "Firstly, it should allow for the development of new polymer formulations at very low throughput rates, which reduces development cost. Secondly, the lab compounder should allow for a reasonable scale-up to a pilot or production plant, which means it can't be too small and has to exhibit all the main features of a production machine. We believe that the chosen shaft dimension of 44mm provides a good compromise with an estimated throughput rate of 30-120 kg/h, depending on the compound."

In contrast to Buss's previous lab compounder, the MX30, the Compeo 44 will feature a much greater degree of flexibility and lend itself better to up-scaling a developed process to a larger Compeo compounder, says Kudrass. "However, we intend to continue supplying the MX30, as it allows for lower throughput rates ranging from 5-25 kg/h. Such low throughput rates can be advantageous for some recipe development applications. "For this reason, we are considering extending the Compeo series by another, even smaller lab machine once the Compeo 44 design is completed."

#### **Continuous solutions**

**Farrel Pomini**'s CPeX is the laboratory version of the company's full-sized compounding system made up of a continuous mixer that discharges into a single-screw extruder for pelletising. The technology, which features two counter-rotating and non-intermeshing rotors, is an effective alternative to twin-screw extruders for compounds and masterbatches with high filler loadings, abrasive or high wear materials and temperature-sensitive materials that require intensive mixing while maintaining low processing temperatures.

The laboratory machine has the same fully functioning orifice as the production-sized machines to control fill level, which regulates the specific energy input to the material. It is designed for feasibility studies and other laboratory work and is targeted for rates of 10-30 kg/hr. Farrel Pomini says it is vey well suited for processing a variety of compounds and colour concentrates.

The CPeX allows users to switch between the standard CP rotor and the XL, which has a longer ratio (10:1) and offers tighter temperature control and increased residence time. It has the same temperature control capability as production size machines. Melt temperature is measured twice, once at the mixer discharge and again at the extruder die for maximum heat and energy control. The mixing chamber has all of the process features of production size machines including mixing dams, liquid injection segments and venting ports.

The mixer discharge orifice coupling the mixer to the extruder allows for molten material to be diverted for evaluation prior to discharging into the extruder feed zone. This "close coupled" design also eliminates the exposure of the molten polymer to air, minimising oxidative degradation risk. The company says this makes it particularly suitable for trials processing reactor supplied powder resin and additive masterbatch.

Farrel Pomini has been making a number of enhancements to the CPeX, primarily in the areas of the control system and reporting, as well adding some features that allow the unit to more closely mirror production-scale Compact Processors. For example, the control system is now configured with feeder selections for major brands; users can choose up to three gravimetric feeders to accommodate full size resin pellets, fillers and additives. It also now includes the ability to capture process parameters within any interval and generate reports. And there is a new historical data export feature that includes individual process parameters in addition to the process parameters of the entire machine.

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More sustainable chemistries and improved performance at lower addition rates are the development focus for the flame retardants industry, writes **Peter Mapleston** 

# Reaching out for better flame performance

Sustainability and the Circular Economy are terms that crop up frequently in many of the most recent announcements of new flame retardant systems for plastics. Suppliers are developing materials that are more effective at lower addition rates and yet continue to perform well, even when the compounds they are used in are recycled several times over. Many of the latest introductions are halogenfree in compliance with latest demands coming from world markets – but not all of them.

"In the future, innovative phosphorous and organobromine compounds will be the mainstay of sustainable flame retardants, particularly in the construction industry," says Karsten Job, Head of the Polymer Additives business unit at **Lanxess**. He explains that Lanxess technical development centres in Leverkusen in Germany and at Naugatuck in Connecticut in the US are working intensively to make such systems available for other polymer classes in the future too.

At K2019, Lanxess's Polymer Additives business shone the light on flame retardance in polystyrene and polyurethane foams for the construction industry. "Organic flame retardants are a key cornerstone of our polymer additive portfolio. Building on our phosphorous compounds that have proven themselves over decades, we have systematically and sustainably consolidated this position in recent years," says Job.

The global phase-out of hexabromocyclododecane (HBCD), previously widely used in EPS and XPS, will conclude at the end of 2021 when China ends its use. One alternative already widely used in the US and Europe is Lanxess's Emerald Innovation 3000 (a polymeric brominated additive which uses technology originally developed by Dow), but the company is also working on the other alternatives.

**ICL-IP** is keeping faith with bromine, and says it is ready for the Circular Economy. "A major issue associated with recycling of flame retarded compounds is properties' resilience, or in other words, to what extend do recycled articles maintain their initial characteristics and more specifically their mechanical properties," says Marc Leifer, Global Technical Marketing Support Manager in the company's Flame Retardants business unit.

"In that context, ICL-IP has invested significant resources: not only by developing sustainable and

Main image: Fire retardant additive suppliers aim to provide more performance at lower addition levels recyclable flame retardants, but also by putting them at work in a wide range of applications and formulations," he says.

#### **Comparing performance**

The company has focused on two major E&E applications: glass fibre reinforced PA66 and PBT, both rated V-0. For PA66 compounds, ICL-IP used a methodology based on five cycles of injection moulding and mechanical recycling, with cycles 2-5 performed by mixing 50% of virgin compound with 50% of recycled material from the previous cycle. It tested six formulations: one with no FR; one with ICL-IP brominated PS (FR-803P) and ATO as a synergist; one with FR-803P and no ATO; one with ICL-IP high molecular weight brominated epoxy (F-2400) and ATO; one with F-2400 alone; and finally one with a commercial non-halogenated flame retardant.

The results were conclusive, Leifer says. Regarding Izod impact strength, all brominated FR formulations exhibit high initial results compared to the non-FR compound, in the range of ±10%, while the non-halogenated FR showed a 40% decrease. Similar trends have been noted for all five recycling cycles (Figure 1).

In terms of tensile strength, the two brominated epoxy-based formulations showed similar initial strength compared with the non-FR alternative. The brominated PS formulations exhibited a 10% decrease, and values for the non-halogenated



Source: ICL-IP

compound were lower by 25%. Once again, the differences changed little over the four rounds of recycling.

The same methodology was used for the PBT compounds, and again there were six formulations: no FR; ICL-IP brominated polyacrylate (FR-1025) + ATO; FR-1025 alone; high molecular weight brominated epoxy (F-2100) + ATO; F-2100 alone; and a commercial non-halogenated flame retardant.

Brominated polyacrylate showed higher impact strength at all stages of the experiment, higher even than the one achieved by the non-FR formulation. The non-halogenated FR showed a 40% decrease for the initial compound and the first recycling round and further recycling cycles could not be performed any further.

As far as tensile strength was concerned, the brominated epoxy-based formulations, with and without ATO, showed 10% higher values than the non-FR alternative at all cycles. Non-halogenated FR values were lower by 50% and could not be taken beyond the first recycling round.

"Polymeric brominated flame retardants not only allow mechanical recycling over several cycles but contribute to maintain critical mechanical properties over time," says Leifer. "By combining the proven sustainability of these high molecular weight materials, the contribution of ICL-IP Polymeric Brominated flame retardant to the circular economy efforts is thus clear and significant."

#### **Multi-functionality**

**FRX Polymers** promoted two new applications for its Nofia polymeric and reactive phosphonate flame retardants at K2019: recycled PET and polycarbonate/PET blends for medical equipment. In PC/PET blends, Nofia provides not only flame retardance but also chemical resistance and heat resistance. This is interesting, says Sales & Marketing VP Ina Jiang, because usually the more flame retardants in a compound, the lower its chemical resistance. This is a problem for medical equipment, which often needs to be sanitised with strong chemicals that can cause stress cracking and other forms of degradation.

Thermal properties as measured by HDT are also better with Nofia compared with incumbent liquid-based phosphorus systems, which tend to plasticise the compound. FRX says customer trials are on-going and claims that some applications are close to commercialisation.

With so many drinks now bottled in PET, recycled PET is obviously a very hot topic in the new world of the Circular Economy. "We see a big advantage for Nofia in PET," says Jiang, "because we get a chain extension reaction with the PET, and we get not only

## **FE** Best Conditions for a Scale-up



The FED-MTS extruder is suited to a variety of applications. The **modular design** of the **FED 26 MTS**, a co-rotating twin-screw extruder can be extended in just a few simple steps from 32D to 42D, 52D or more.

The FED 26 MTS is ideal as a lab extruder – the technology inside is similar to that of the larger machines in the MTS series and thus provides virtually the same gentle compounding processes.

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Right: Clariant is using Neste's renewable hydrocarbons in its Exolilt OP Terra flame retardants better flammability properties but also better mechanical properties and processability." This is said to eliminate the need for any separate solid stating stage to improve viscosity.

Large volumes of old PET bottles are current recycled into fibres, Jiang points out. "Automotive companies increasingly want to use recycled materials and they also want flame-retardant materials. At the moment, this does not give them many choices. We can make it possible for them to use

fibres containing 100% r-PET (or more accurately 97% r-PET and 3% Nofia). This compares with a normal 50/50 virgin/recyclate blend." Potential applications include headliners and other interior surfaces.

#### **Renewable options**

Use of renewable feedstocks to address the sustainability issue is a practice well established in polymer production, but much less so in additives. That situation is changing, however. **Clariant**, for example, has teamed up with renewable hydrocarbon producer Neste to offer a broad range of additives, including Exolit OP Terra flame retardants. These are based on mass balance certified ethylene and propylene from renewable feedstocks, such as waste animal fat and residue vegetable oils.

Mass balance is a certification that may need some explanation. Exolit OP Terra grades are produced in the same Exolit plant as regular Exolit OP grades. The crackers that produce the ethylene feedstock for all these grades are fed with crude, non-renewable oil and also with certified renewable feedstock. So all grades are derived from renew-



able and non-renewable feedstocks. Clariant designates some grades as being made from renewables and some from non-renewables according to the feedstock

content, determined by mass balance techniques.

So, mass balance is, essentially, a way of accounting for all material entering and leaving a system, in this case to prove that no greenwashing is going on. In other words, if one third

IMAGE: NESTE

of the feedstock comes from renewables, only one third of all Exolit grades can be designated as Terra grades.

There are six grades in the new Exolit OP Terra range of halogen-free flame retardants, all of which are based on aluminium diethyl-phosphinate (DEPAL). Clariant says they are the first to be based on renewable sources and to be proven not to interfere with the recycling process. They achieve UL 94 V-0 rating with stable flame retardancy even after multiple recycling processes. Application areas include electronic and electrical equipment and automotive components.

Neste says that its proprietary NEXBTL technology allows it to make top-quality renewable diesel and other renewable products out of almost any waste fat or vegetable oil. The company claims to be the leading producer of renewable diesel in the world, with an annual production capacity of nearly three million tonnes.

#### **Recycling results**

Confirmation from the Fraunhofer LBF Institute over a multi-year research collaboration with Pinfa that Exolit OP continues to deliver the same high-level fire protection throughout many recycling and reuse cycles is a further boost to sustainability, Clariant says. It claims that postindustrial waste of glass fibre-reinforced polyamide containing Exolit OP provides manufacturers with a genuine alternative to new material. Additives can ensure that mechanical performance is also not affected, meaning that internally recycled waste or regrind material can be used to produce the same applications without the need to downcycle.

"In addition, Exolit OP is not subject to ecodesign application restrictions, for example the upcoming regulation for electronic displays based on the EU Ecodesign framework Directive (2009/125/EC)4 covering the recycling of plastics, which limits the use of halogenated flame retardants in enclosures and stands of electronic

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Right: Clariant sees its Exolit OP halogenfree flame retardant allowing more recyclate usage in E&E & automotive parts displays," the company says.

**Budenheim** highlights the use of its halogen-free additives in bio-composites such as wood-reinforced plastics (WPCs). It cites the example of its Budit 620, which is based on coated ammonium polyphosphate, saying it is suitable for outdoor applications due to its high stability and water resistance. With addition rates of around 20%, depending on the formulation and fibre content, compounds are said to obtain UL94 V-0 ratings at 4mm.

Budit 381, also based on APP, is intended for indoor TPU applications with low moisture contact and V-0 ratings can be obtained when it is combined with anti-dripping agents, the company says. Budit 344, also for TPUs, has higher water resistance. It can be used as a stand-alone solution at low loadings to serve high mechanically-demanding applications, while at higher loadings in synergistic combination with phosphinates it stops dripping in the UL 94 test. Finally, the company highlights Budit 669, an intumescent system based on APP with a special coating that it says shows superior mechanical properties and no migration/ blooming within the polymer.

One of **Thor**'s most recent developments is the Aflammit PCO 9xx family of phosphonate-based high-performance flame retardants. Thor says standards such as DIN 4102 B1, NF P92503/504 M1 and UL 94 V-0 can be passed with dosages as low as 4-8%, depending on the material thickness and standard required.

The new additives were primarily designed for use in polyolefins but can also be used in other polymers, Thor says. "In combination with synergistic radical generators, for instance NOR-HALS, manufacturers can achieve transparent films or foams or moulded pieces with excellent mechanical properties and low density," says a spokesperson.

Also eyeing applications in films is **Techmer PM**. Research & Development Engineer Kaan Serpersu says: "Increasingly, we have been receiving





requests where a clear film is needed in the final applications with FR properties. Typical halogenated formulas result in opaque films, especially at FR loadings needed to pass NFPA 701 Test Methods 1 and 2. Many of our customers, especially those with global markets, have been moving towards non-halogenated technology for regulatory needs. We developed PM117000 specifically for these applications where high clarity and FR properties are needed. PM117000 is good for up to 600°F [315°C] making it good for both film and extrusion coating processes. It passes NFPA 701 Test Method 1 and 2 even at thick gauge polyolefin film and produces high clarity film."

#### **Expandable graphite**

**Georg H Luh** supplies expandable graphite, another mineral-based halogen-free flame-retardant additive, which it sources from a Chinese producer. "The production process has long since been standardised, resulting in reproducible products that are subject to regular controls," the company says. "Expandable graphite has already established as a flame retardant in the automotive and construction sectors and is regarded by industry as a safe and long-term flame-retardant solution for these applications. In more and more applications, the existing flame retardant is replaced by expandable graphite or is used as flame retardant additive," it claims.

The company says that product properties – notably pH value and expansion volume – can be individually adjusted. "However, not all properties can be adjusted and combined equally. In particular, the settings for particle size and starting temperature have their limits. In order to expand our product range here as well, our products are constantly being further developed and tested."

The company goes on to say that in the discus-

Budenheim's Budit 620 can be used in WPCs for outdoor applications

**Below:** 

sion about applications for thermally and electrically conductive plastics, the focus is often not only on conductivity but also on the flame retardancy of these components. "Expandable graphite not only makes the component flame-retardant, but also electrically and thermally conductive. With only one single additive, the requirements of conductivity and flame retardancy can be achieved and perfectly combined," says Angelina Schöffel in Technical Customer Support & Marketing at the company.

#### **Mineral solutions**

**Quartzwerke** division HPF The Mineral Engineers (HPF) is working on development of kaolin and wollastonite as synergists for phosphorus-based FRs (phosphinates and phosphates) in polyamides. These mineral fillers increase mechanical properties such as tensile elongation and modulus, as well as HDT, while reducing the amount of the principal FR needed. Commercial phosphorus-based FRs currently on the market are added at levels of around 20%, normally in compounds containing 30% glass fibres. But HPF says a mixture of 14% flame retardant and 30% of its synergist will yield the same flame retardance.

Thorsten Hilgers, in product development, plastics, at HPF, says that glass fibres give better mechanical properties but explains that improvement is not always required. So, if a user does not need high-level mechanicals but does want to cut the total cost of the flame-retardant package, then the use of these mineral fillers could be an answer. "HPF's intention is not to replace glass in compounds but rather to open up new applications for flame retardant polyamides where they currently may not be used because they are too expensive," he says.

Depending on the exact type of phosphorusbased flame retardant, kaolin may work better as a synergist than wollastonite or vice versa. "We are not sure why. We think the wollastonite could stabilise the crust formation with phosphates," says Hilgers. Development work continues.

The HPF technology also works in PBTs, where it is possible to reduce the level of phosphorusbased FR down to 8%.

Applied Minerals, headquartered in Brooklyn,

Above: Georg H Luh says expandable graphite is a proven flame retardant in automotive and construction applications

MAGE: GEORG H LUH

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Above: Halogen-free flame retardant systems are gaining ground in electrical applications NY, claims to be the leading producer of halloysite clay and advanced natural iron oxide solutions from its Dragon Mine property in Eureka, in Utah in the US (which is the largest commercial source of halloysite in the western hemisphere). The company's Dragonite halloysite clay products are described as multifunctional additives that not only act as a synergist with different flame-retardant systems but also provide other features such as enhanced nucleation (especially in polyethylene) and an increase in tensile and flexural strength without compromising impact strength. In films, they can also cause a significant decrease in thermal conductivity as well as improved barrier to gases, scavenging of ethylene gases and the controlled release of antimicrobials.

Dragonite is loaded at a rate typically between 1-3 wt% in the final polymer formulation. The choice of grade is based upon whether the polymer is susceptible to degradation by acidic surface hydroxyl groups in the clay.

#### Halogen-free gains

**Songwon** is targeting halogen-free flame retardants with its new Songflame organic synergists for plastics and coatings. They are based on a platform technology that the company began working on around three years ago. It is looking at applications in electrical and electronics and says that during the development phase it has received a positive response from the market.

"We are pushing the boundaries and giving more possibilities for halogen free flame-retardant materials," says André Le Gal, Leader, Market Center Flame Retardants. "We are working on obtaining improved cost efficiencies, and we are also going for higher performance. We have a building block that is quite broad in terms of application potential."

The new synergists, which are effective in both

the solid and gas phase of a fire, are said to work best with all types of phosphorus-based derivatives, and also in intumescent systems for coatings and plastics (polypropylene for example), where Le Gal says the effect is quite strong. They are effective at loadings as low as 0.5-2.0%. Their fine particle size gives them "excellent" dispersibility, it is claimed.

"The flame retardant loading is almost always associated with major drawbacks when it comes to mechanical properties or electrical properties, as well as adding a substantial formulation cost," says Le Gal. "We see a clear differentiating edge over other synergists."

**Paxymer** continues to market its functional polymer-based synergist for halogen-free flame retardants. The company has previously had success in reducing the amount of one such product, Adeka FP2500, while maintaining V-0 properties. "A number of phosphorus/nitrogen chemistries are currently being evaluated," says Managing Director Amit Paul.

"Paxymer can typically reduce the P/N additive content by 4-8% with an addition of the organic synergist between 0.5-2.0%. The technology works well in polyolefins. The synergist has also shown promise in glass and natural fibre filled polymers." The company is currently working on filled PP grades with talc and CaCO<sub>3</sub>. "It is a significant challenge to achieve V-0 with halogen-free solutions [in such compounds]," he says.

The company says it is also developing novel analytical techniques for gas-phase characterisation of FR additives. "The market needs to be able to find and optimise competitive, functional and efficient formulations quickly," says Paul. "This is particularly useful when involved in costly largescale testing such as the EN13501. The analytical tool-kit enables comparison of efficiency between different chemistries and formulations with the aim of providing a better starting point for formulation. This reduces the need for large Designs of Experiments and allows for more precise optimisation and faster deployment of formulations."

The Paxymer technology works by providing char reinforcement. It propagates cross linking at fire temperatures and acts as a non-dripping additive as a replacement for commonly used fluoropolymers. It also reduces and delays the peak heat release rate.

#### Liquid synergists

**Momentive** recently introduced SFR 100 silicone fluid, a new liquid synergist that can be used in various polymers, including polypropylene, polyethylene, polycarbonate and other thermoplastics. It is a multifunctional additive that can help with the dispersion of solid FR additives, has synergies with ATH, MDH, and organo-phosphorus additives, and helps improve mechanical properties such as low temperature impact strength and elongation at break.

Monjit Phukan, Global Technology Manager Polymer & Electronic Additives, says that "SFR 100 is able to help the dispersion via hydrogen bonding, due to the hydroxyl groups that the additive carries. Under some temperature and processing conditions, grafting of SFR 100 silicone fluid can also take place causing in situ surface modification of the filler." He adds that improved dispersion of the filler can help with processing – it may be possible to mould at lower pressures as well as fill thinner wall sections.

The company has also introduced a methylphenyl silicone resin, Y-19320, which can act as a primary flame retardant. It has shown a high level of flame retardance in clear polycarbonate FR compounds, and in parts with 1.6mm thickness has demonstrated its ability to achieve a UL94 V-0 performance while offering 98% clarity at loadings between 1 and 4%. Phukan says this represents, "a potentially benign, more sustainable technology compared to some phosphorous-based flame retardants that are under scrutiny for their potential toxicity due to environmental concerns."

In addition, Phukan says that, because the additive is non-reactive, compounds in which it is used can potentially be recycled many times without loss of FR performance through degradation. Y-19320 is a low molecular weight crosslinked material with a network structure, supplied in the form of a low viscosity resin.

According to Momentive, it can not only reduce the flammability of polycarbonate, but also stop dripping in a fire by crosslinking the burning fluid. This is said to make it possible to obtain a V-0 rating (when used in conjunction with an anti-drip additive).



Phukan also claims an advantage in terms of combustion rate and potential cost-effectiveness over octaphenyl cyclotetrasiloxane (OPCTS). In testing, at addition levels of 1.5%, he says Y-19320 demonstrated a 30% lower maximum specific combustion rate than OPCTS. The flame retardant can also be considered for use with other clear polymers, such as PMMA. It is based on a new platform technology from which other likely additions to the family and more generations are expected.

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## Graphene: one to watch?

Use of graphene in polymer compounds is in its early stages, but suppliers are confident that a proliferation of development partnerships make this a material to keep an eye on, writes Jennifer Markarian



The broader use of graphene nanomaterials in composites is certainly at a very early stage but many experts hold high hopes that graphene will prove to be a performance-enhancing nano-additive for thermoplastics (as well as finding application in other non-plastic applications ranging from battery anode materials to concrete and even clothing). As a consequence, academic researchers press on with projects to improve capabilities, nanomaterial manufacturers are launching partnerships, and graphene industry associations are adding members as they seek to drive commercialisation and industry growth.

Carbon-based nano-materials can be produced in various forms, including multi-wall and single-wall carbon nanotubes (MWCNTs and SWCNTs) as well as graphene nanoplatelets. Structurally, MWCNTs can be imagined as a rolled sheet, SWCNTs as a tube and graphene nanoplatelets as two-dimensional flat sheets (SWCNTs are, for this reason, sometime referred to as graphene nanotubes).

The structural form is significant in determining the specific property set. "Different morphologies and surface energies produce different composite properties, because nanocomposite properties depend on the bonds between the layers and functionalities at the edges of the nanomaterial. Behaviour also depends on adhesion to the target polymer system," explains Bamidele Ali, Chief Commercial Officer at **XG Sciences**, which is focusing on graphene nanoplatelets where they see the most opportunities for commercialisation in a wide range of applications and markets.

Graphene was first isolated back in 2004 at the **University of Manchester** in the UK. It now hosts the National Graphene Institute, the collaborative Graphene Engineering and Innovation Centre (GEIC), and the Henry Royce Institute. The latter focuses on materials, including graphene.

In a presentation at AMI's Performance Polypropylene conference in Germany in May this year, Dimitrios Papageorgiou, from the National Graphene Institute, shared some of the potential uses for graphene in composites, including structural reinforcement in polymer nanocomposites. He presented research that looked at combining graphene nanoplatelets and short glass fibre reinforced PP that found that the fillers "act additively in the hybrid system."

Meanwhile, UK-based **Colloids Group**, a subsidiary of Tosaf, is funding a joint collaborative PhD research project at the GEIC. The three/four-year project aims to develop and scale up new polymergraphene nanocomposites with enhanced properties and that offer multifunctional capabilities that are not currently available. The research, under the guidance of the Colloids R&D team, will take place at the University of Manchester with the Advanced Nanomaterials Group led by Dr Mark A Bissett and Professor Ian A Kinloch. The researchers will look at Main image: Colloids is funding research at the University of Manchester to develop graphenebased compounds and masterbatches MAGE: COLLOIDS



Above: The National Graphene Institute is located at the University of Manchester in the UK, where graphene was first isolated in 2004 graphene in thermoplastics and how properties (such as mechanical, thermal, electrical, rheological, and gas-barrier) are affected by the materials and the production process. Colloids expects to develop "next generation" graphene nanocomposite products for target markets including automotive, aerospace, and electrical and electronics.

In the US, the National Graphene Association (NGA), which is headquartered in Nashville in Tennessee and advocates for the commercialisation of graphene, is actively growing. The NGA connected with the GEIC in the UK in late 2018 as an affiliate partner. And in 2019, NGA added several companies to its Graphene Industry Council, including Applied Graphene Materials (a graphene nanoplatelet producer), XG Sciences, and Global Graphene Group (a holding company for five subsidiaries, including graphene and nanocomposite production).

#### **Cutting the cost**

At **Rutgers**, the State University of New Jersey, Dr Thomas Nosker and his research group have developed a patented process to produce low-cost graphene nanocomposites by distributing graphite and graphene nanoparticles in a molten thermoplastic and exfoliating the graphite to graphene nanoparticles *in situ*. This avoids the problems of difficult dispersion and weak bonding that may be associated with exfoliating graphene and then subsequently dispersing it in the polymer.

Right: The plate-like structure of graphene provides extensive polymer modification potential

Nosker says the process creates good dispersion and covalent bonding between the graphene and the polymer matrix, resulting in significant improvements in both stiffness and impact strength (similar to the level of improvement seen with carbon-fiber composites). The process is currently running on a pilot line at output rates up to 45 kg/h but the researchers are working on scaling up to commercial scale and aiming for an output of 225-450 kg/h. The research is sponsored by licensee **TLC** 

Products. "We expect to be ready for commercial

production in 2020," says Charles Chang, CEO of TLC Products. "Right now, composites users have to choose between glass fibre (which is strong and cheap but heavy) and carbon fiber (which is strong and light but expensive). In three to five years there will be a third choice that fits between glass fibre and carbon fibre–graphene is strong, light, and cost-effective."

Chang says graphene composites will potentially find application anywhere glass or carbon fibre find use, and where the black colour is not a concern. Automotive is a key example, where light-weighting is especially important for electric vehicles.

#### **Proven in production**

**OCSIAI** operates a SWCNT - it uses the description graphene nanotubes - manufacturing plant with capacity of more than 50 tonnes per year using patented technology that the company says allows low-cost manufacturing. Its Tuball nanotubes are already used in a range of polymers in applications where they provide a high level of electrical conductivity and good mechanical properties, says lan Fellows, US Sales and Marketing Director for the company.

Fellows says that in the industry as a whole, the current use of graphene in polymers is predominately for mechanical properties and thermal conductivity, rather than electrical conductivity. "In the near future, the adoption of graphene materials in polymers will increase significantly, creating new materials and new applications to grow the market as a whole," he says. "At OCSiAI we are working to offer our products to the market in order to provide a higher level of performance as well as strong electrical conductivity properties."

At the company's Nanoaugmented Materials Industry Summit (NAUM '19) last month, one application on display was a thermoplastic vehicle panel with improved mechanical properties. Using


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Right: An antistatic film (left) containing OCSiAl's SWCNTs alongside a standard film pack nanomaterials to add electrical conductivity to panels eliminates the need for separate application of a conductive primer before electrostatic painting.

Also shown at NAUM'19 was Trelleborg's graphene nanocomposite for wind turbine parts that absorb radar waves to significantly reduce the problem of their large radar cross-section. The material is based on a TPU matrix.

The very high surface area of nanotubes makes dispersion challenging so OCSiAl offers predispersed forms of its Tuball graphene called Tuball Matrix. These are said to enable faster mixing and easier handling. The company says that the concentrates, in which Tuball is mixed with a dispersant, must be diluted to the correct concentration level according to the instructions provided.

In June this year, OCSiAl licensed the Matrix technology to **Skintech**, a Brazilian nanotechnology company, which will manufacture and supply Tuball Matrix to customers in Brazil. Regional manufacturing facilities will reduce delivery costs and time, according to OCSiAl. In the Americas, the initial focus for Tuball is on electrostatic discharge (ESD) flooring using coatings (for example, epoxy or urethane). Tuball means the flooring coating thickness can be reduced, allowing faster installation and supporting a broader colour palette for flooring in applications such as electronics manufacturing, chemical plants, and hospitals, says Fellows.

Versarian continues to work on commercialisation

investors in January of this year, Head of Commer-

"engagements" at various stages of development.

The company offers its Polygrene range of polymer

compounds and masterbatches with varying levels

of graphene in different matrix polymers.

cial at Versarien, David Kerr, pointed to a host of

of graphene from 2-Dtech, a subsidiary of the

University of Manchester. In a presentation to

#### **Chasing commercialisation**

Below: An electron micrograph image showing the structure of Versarian's Nanene graphene platelets





process of constructing a facility for commercial production of graphene. The company aims to have 4,000 tonne/yr running by early 2020, with plans to eventually have capacity of 10,000 tonne/yr. Markets for the company's graphene-enhanced plastic and composite products are expected in areas such as transportation, packaging, and electronics, where they can improve a range of properties, including barrier, UV and chemical resistance.

The company recently filed a patent on its process for dispersion of graphene in polymers. "Using this new cost-effective and highly scalable method enables us to get the same properties that a traditional graphene compounding method would give, but using only one third of the graphene concentration," says Liam Farrell, CEO of NanoXplore.

Research at the company has found that adding 1% graphene to HDPE increases the resistance to oxygen and humidity permeation by up to 30% and also improves thermal and UV degradation performance, according to Dr Nima Moghimian, NanoXplore Product Development Manager. The researchers have also looked at the combination of graphene with glass fibre in pultruded products and found improved mechanical properties.

Farrell says that the company's GrapheneBlack can also address sustainability by improving mechanical performance. "Graphene delays the thermal degradation of polymers in each processing step and therefore increases the material's lifetime; the material can be recycled and reused more frequently than before. It also improves the physical properties of the resin, which could compensate the loss of these properties in the recycled materials," he says.

#### **Unlocking performance**

**XG Sciences**, based in Michigan in the US, manufactures xGnP graphene nanoplatelets. The company supplies graphene-enhanced masterbatches, dispersions, and fully formulated compounds. "Graphene offers significant product benefits, but unlocking properties is challenging," says Ali. "We've spent a lot of time figuring out how to process and create solutions for our customers." Ali says that current

Ali says that current megatrends in the plastics industry, such as light-weighting and "right-sizing" packaging, create opportunities for graphene, which can act as a UV blocker and add barrier properties. "Graphene can

provide multiple composite benefits while potentially reducing the need for other additives," he says.

Commercially, XG Sciences has had a busy year. In June, the company entered a partnership with the Graphene Applications Development Center (GADC) in China, which is a joint venture between Sinochem Plastics and Yuyao PGS New Material Technology. The GADC aims to develop graphene-enhanced thermoplastic composites for end uses including automotive, industrial, and for consumer items to be

PLASTIC STRAND PELLETIZING.

manufactured and sold in China. XGSciences is also working with Niagara Bottling- which operates bottling facilities in the US and Mexico - to develop and commercialise graphene in PET for beverage bottle and packaging uses. "For years we have used our expertise to innovate for Niagara Bottling's customers. In this partnership with XG Sciences we are now advancing those innovations to the broader

packaging industry," according to Jay Hanan, Chief Scientist at Niagara. "We are

excited to further enable our industry to utilise graphene to create more efficiently produced and user-friendly packaging."

The partnership intends to sell branded XGPET masterbatch pellets to global packaging companies. The additive improves strength properties, enhances processing, and may allow light-weighting of some bottle designs. Although high levels of graphene make dark-colored parts, the companies Right: A grapheneenhanced masterbatch developed by XG Sciences



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## Birla looks to nano with Chasm deal

Carbon black producer Birla Carbon and Chasm Advanced Materials, a US-based specialist in printed electronics materials and battery materials, have agreed to develop and manufacture hybrid nanomaterials based on carbon substrates and carbon nanotubes. These will be targeted at multiple market segments, including tyres, batteries and coatings.

"The combination of Chasm's expertise in nanotube enhancement and our deep knowledge of carbon substrates and applications offers us the chance to rapidly advance our understanding of these high-performance, scalable nanomaterials," said Birla Carbon CEO Dr Santrupt B Misra

have worked to develop formulas that maintain transparency, says Ali.

#### **Opportunities in 3D print**

Most recently, XG Sciences announced a collaboration with Illinois, US-based 3D printer filament company, Terrafilum Engineered Filaments, to develop 3D printing filaments containing graphene for fused filament fabrication (FFF) or fused deposition modeling (FDM) printing. Limitations of FDM include direction-specific structural weakness and slow processing speeds. The graphene additive is expected to help resolve both of these problems-improved thermal conductivity allows faster processing, improved part strength overall, and enhanced z-direction strength in particular, which allows higher builds, says Ali. The project partners say that, because graphene also provides ESD properties, it can address a currently unmet market need for robust ESD filaments.

Meanwhile, Swedish companies **Graphmatec** (which recently opened a factory for graphene solutions) and **Add North 3D** (a 3DP materials developer) last month introduced Koltron G1, an FDM 3D printable filament material made with Graphmatec's Aros Graphene. The companies say



Chasm Advanced Materials acquired Southwest NanoTechnologies in 2015 and has since, backed by venture capital, expanded its application development centre at Canton in Massachusetts in the US and its production plant and R&D centre at Norman in Oklahoma.

the filament is electrically and thermally conductive, flame retardant, and has high mechanical and chemical resistance. The graphene also gives printed parts self-lubricating properties. Target applications include EMI/RFI shielding and wearable and printable electronics.

At the NAUM '19 conference, **Lehvoss Group** described its 3D print compounds made with graphene nanotubes, which it says are the first conductive laser sinter materials in the market. The materials are suitable for powder bed fusion and FFF 3Dprint systems, with potential applications including trays, housings, and medical equipment.

Elsewhere in the 3D print world, Finland's **Carbodeon** has partnered with **UPM Biocomposites**, which has factories located in Finland and Germany, to produce 3D printing compounds based on UPM's cellulose-PLA biocomposite containing Carbodeon's nano-diamond additive. The nanodiamond additive is said to improve printing speed and properties, including stiffness, strength, and heat deflection temperature. The companies are developing filaments for fused filament fabrication and granules for large-scale fused granular fabrication.

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# Taking on the weather

Accelerated weathering testing can provide vital data in the development of plastics for outdoor applications, but the need for validation remains. **Mark Holmes** reports

The outdoor performance of plastics has improved significantly over many decades through developments in stabiliser and pigment technologies in ever more stable and durable compounds. Understanding the performance boundaries of these compounds is essential to matching the materials to the outdoor application. Accelerated weathering testing is now a well-established technique in determining these parameters, although the need to correlate these findings to real-time outdoor exposure remains vital.

Accelerated weathering testing for plastic compounds has been vital for the industry for many years and the fundamental and most basic requirement is to provide the most reliable results in the quickest amount of time. "These have been the main market requirements for some time," says Matt McGreer, Senior Product Manager/Global Standards Manager, **Atlas Material Testing Technology**. "Beyond that, the next level of requirement involves a more complete understanding of what is really happening at the sample level in terms of the radiation received, surface temperature and moisture application, for example, beyond just the basic test method parameters and set points."

However, improvements in accelerated testing techniques are also closely aligned to the development of standards. "Users of accelerated testing instruments are always driven by the requirements in test methods and industry standards," says McGreer. "If those requirements do not include new developments or improvements, then the market success of that new feature can be limited. As standards development can be very competitive, if not all weathering instrument manufacturers provide instruments that have that new feature, it is difficult to get agreement for its inclusion because it puts that company at a distinct competitive disadvantage."

McGreer says it is important that during the standards development process, enough technical data justifying the benefit of a new technology to the plastics industry be made available. A sufficiently strong technical argument can compel the adoption of state-of-the-art features that will ultimately enable more sophisticated materials' development.

One essential requirement in achieving true service life prediction is an understanding of what is really going on at the sample level. "Existing instruments in the field that may be perfectly capable of running that basic test method may not be equipped with a new development that gives the user this critical knowledge," he says. "There have been many recent papers and presentations at industry and standards symposia that have highlighted the need for this information, as well as ways in which this data can be collected. Atlas has two relatively new developments that assist in providing more information about what is really happening to a sample during exposure. These include the Specific Specimen Surface Temperature (S<sup>3</sup>T) Main image: Simulating the effect of sunlight and outdoor exposure is a big challenge for compound developers but accelerated methods and understanding is improving

![](_page_45_Picture_2.jpeg)

Above: The Specific Specimen Surface Temperature (S<sup>3</sup>T) system from Atlas collects actual sample surface temperatures

Right: The Atlas All-In-One-Sensor collects controlled test parameter data right at the sample surface The Specific Specimen Surface Temperature (S<sup>3</sup>T) system is a means of collecting actual surface temperatures of exposed samples during exposure. It uses a non-contact pyrometer for the actual surface temperature measurement and special RFID functions to index and determine the actual temperature measurement that applies to each sample. This provides a significant improvement in

system and All-In-One-Sensor (AIOS) technology."

information about actual temperatures over the 'black panel', which has been traditionally used to control accelerated weathering tests but does not provide specific surface temperature data.

All-In-One-Sensor (AIOS) technology allows for controlled test parameter data to be measured right at the sample surface. Current instruments typically have certain control parameters, such as chamber air temperature and relative humidity, measured in areas away from the actual sample exposure area. Not only does AIOS allow for measurement of critical weathering factors at the sample level, but the calibration device can be placed in other weathering instruments to ensure reproducible tests, or in outdoor weathering test facilities to compare real-world weathering parameters with the accelerated tests, or even in specific outdoor environments that could be used for test method development.

**New standards** Atlas has recently been involved with the development of a new automotive exterior test method that has been published as a new standard, designated ASTM D7869. While this standard was originally developed for coatings in the automotive and airline industries, it is now being adopted (sometimes with minor deviations to better simulate specific applications) for plastics as well.

"This study was a long-term collaboration

between automotive and airline OEMs, their suppliers and weathering testing companies to design a complex test cycle that better replicated that of a southern Florida subtropical climate, considered to be a benchmark location for weathering testing," says McGreer. "This cycle takes advantage of current state-of-the-art control capabilities to truly simulate the stresses incurred by materials exposed to this environment. The development took over ten years, and included a full characterisation of the climate, how that climate could be simulated in accelerated weathering instruments, research into how the various weathering factors affected materials exposed to that climate, and the validation to show improved acceleration and correlation of a variety of materials."

Atlas also highlights possible areas for future improvement in accelerated testing. "There has been quite a bit of recent work done to improve the simulation of sunlight with better filters," McGreer says. "While the S<sup>3</sup>T system improves our understanding of sample surface temperatures, the next issue to address may be that of moisture - the third factor of weathering. It may be possible that improvements or features could be employed to better understand the impingement of spray on a sample to simulate rainfall. Another feature that is less associated with the actual functional tests, but more with how that data is collected, is to consider leveraging IoT and technology associated with that to provide easier, more complete and remote access to instrument data during a test."

#### **Fundamentals retained**

In terms of the main market requirements for accelerated weathering testing for plastic compounds, Andy Francis, Marketing Director, **Q-Lab Corporation**, says he does not believe that the

![](_page_45_Picture_14.jpeg)

fundamentals have changed. "Companies still perform accelerated testing with UV fluorescent and xenon arc instruments using the same suite of test standards they have for some time. There is some interest in metal halide testing and potentially LED in the future, and some exploration of new accelerated test cycles, but most users stick to basic, established tests," he says.

"Testing is usually around colour change and physical property degradation caused by exposure to light. A lot of it is for quality control and for supplier qualification, though some more advanced users are performing R&D testing and correlating to outdoors. Nevertheless, there is always a desire to accelerate results even further. We caution users that over-accelerating can lead to unrealistic results, but managers are frequently pushing for faster test cycles with higher irradiances to get results in shorter time frames," he says. "In order to meet these demands, we have introduced our UVA-340+ and UVB-313EL+ lamps, which offer the highest maximum irradiances of any UV fluorescent tester, plus extended guaranteed lifetime of 1500 hours at popular high irradiance levels like 1.55 W/m<sup>2</sup>/nm. Some customers are turning to these for highly durable products."

One area of study that Q-Lab has been involved in recently concerns replacement of inorganic colour additives in plastics, such as PVC, with organic additives. "While organic pigments are often better from a safety perspective, they often have decreased lightfastness performance," Francis says. "Performance of these coloured materials in outdoor environments can be studied with natural and accelerated weathering testing. Sunlight can cause different weathering phenomena, such as yellowing and colour fade, depending on the amounts of incident UV or visible light. This is

![](_page_46_Figure_4.jpeg)

compounds under different test methods Source: Q-Lab Corporation

	Florida	Outdoor	Day	light	Exte	nded IV	UVA	-340	UVB	-313
Color	ΔE	Rank	ΔE	Rank	ΔE	Rank	ΔE	Rank	ΔE	Rank
Smoke	0.6	1	1.0	1	1.8	1	1.3	1	3.6	1
Green	2.0	2.5	2.0	2	5.6	2	1.8	1	16.7	3.5
Yellow	2.5	2.5	5.0	3.5	6.3	3	4.7	3	43.0	7
Blue	4.7	4	5.2	3.5	7.2	4	5.7	4	21.0	5
Chartreuse	5.6	5	7.7	5	11.0	6	11.9	6	25.5	6
Orange	8.6	6	11.2	6	11.4	6	10.2	5	17.7	3.5
Red	14.0	7	35.0	7	11.8	6	16.8	7	14.3	2
Purple	39.0	8	42.0	8.5	40.7	8	26.6	9	50.7	8.5
Pink	71.9	9	41.3	8.5	65.3	9	19.7	8	49.7	8.5
Rank ord with O	ler corre utdoors	lation >	0.	98	0.	96	0.	95	0.	54

Excellent color change correlation between FL outdoors and accelerated except UVB-313 Figure 1: Correlation of accelerated versus outdoor exposure for different coloured PVC compounds Source: Q-Lab Corporation

where accelerated weathering testing, in conjunction with outdoor exposure, is vital."

The PVC weathering programme included outdoor exposure, UV fluorescent and xenon arc testing. Accelerated weathering testing of different coloured PVC plastics was performed and colour change ( $\Delta$ E) measured. This involved outdoor exposure for two months (Florida) and accelerated laboratory testing for 200 hours (UV fluorescent and xenon arc). Significant differences in the extent of colour change were observed among the nine different colours.

The correlation for colour change was compared for accelerated tests versus outdoor tests (Figure 1). Very good rank order correlation was observed for xenon (daylight or extended UV filter) and UV fluorescent (UVA-340 lamps) testing, however, there was poor correlation for UV fluorescent UVB-313 lamps (Figure 2). This matches typical expectations from these light sources, as UVB-type lamps are intended more for quality control purposes than for matching outdoor results.

Different degradation was also observed for pigments and base plastics. There was darkening from plastic yellowing resulting from shortwave UV, with fade from the breakdown of pigments from visible light. Differences were most pronounced for pink and red specimens, illustrating the need for thorough colour characterisation beyond colour change.

"There is no 'magic number' for accelerated testing," says Francis. "Weathering testing is strongly material-dependent. Good correlation for colour change, for instance, does not necessarily mean good correlation for physical properties. Understanding your failure mode is key and retesting must be done any time materials' chemistry is modified. Outdoor weathering data is critical for

![](_page_47_Picture_1.jpeg)

Above: Application and customer performance needs dictate requirements for accelerated weathering testing for a given plastic compound correlation and to validate accelerated tests - it is important to Test the Test."

Long-term sustainability and environmental considerations for plastics may also affect accelerated weathering testing in the future. "There may be a need going forward to develop accelerated testing guidelines for some materials to ensure that they do break down upon exposure to weathering elements," Francis says. "This is a paradigm shift basically from the complete history of weathering testing, where the goal has been to verify that products and materials could withstand outdoor conditions."

#### **Understanding applications**

The application type and customer performance needs dictate the market requirements for accelerated weathering testing for a given plastic compound, according to Avery Dennison, a leading manufacturer of labelling and functional film materials for plastics with extensive experience of weathering assessment. "A material applied to a flat application, such as a sign or building, will have different physical property requirements than a material applied to a complex geometry, such as a vehicle for example. The purpose of both applications might be the same, such as to provide a certain colour or appearance, but the means to achieve that property could be guite different based on the substrate type and design features that it is applied to," says Mark Alesandro, R&D Product Durability Manager.

Accelerated weathering testing in a xenon arc tester at Avery Dennison

**Right:** 

In the case of the flat surface application, Alesandro says a wider range of material options might be considered as it allows for greater variation in physical properties - thickness and stiffness. A three-dimensional application will require materials that have high elongation and conformability properties. "Since the application determines the material options, it inherently factors into the cost and durability considerations as well. The challenge is often not in finding a material solution that meets the given market requirements, but rather finding one that is cost competitive and long lasting" he explains.

"It is obvious that the market requirements will vary with different materials and different applications, but it is also interesting to consider that these requirements often vary from customer to customer for the same material and application types. The reason for such variation is that each customer may define a material property failure differently," he says. "For example, if a given plastic compound applied outdoors shows cracking after five years, it is likely that all customers would agree that the material failed at this point and therefore has five year durability. However, if the material remains physically intact and instead demonstrates colour fading or gloss loss with time, there is likely to be a much wider criterion used to define the failure point and material durability. Therefore, the same material used on equal applications can have different durability depending on the customer requirements and how they define failure."

Alesandro says the ongoing pursuit of correlation to real world ageing remains the main factor driving the advancement of accelerated testing, with the most common question asked by customers being how many hours of testing equal a year outdoors? "This question ultimately assumes that the accelerated testing is reproducing real life exposures, but in a much shorter time frame. From this, it is important to consider that there are numerous accelerated testing methods available from the Standards Committees. Additionally, many customers have their own internal accelerated testing methods. Each of these tests utilise different exposure cycles, varying temperature and humidity conditions, and different irradiance levels which represents the sunlight intensity," he says.

"In the same way that there are numerous

![](_page_47_Picture_13.jpeg)

environmental and climate conditions throughout the world, there is also a wide range of test methods that attempt to simulate these conditions. So unfortunately, the answer to the accelerated testing question is always – it depends. It ultimately relies on establishing the actual acceleration factor for a given material in a specific accelerated test method with the real-life outdoor ageing of that same material in a given location at a given angle of application," Alesandro explains.

"Considerable industry advancements have been made in tuning the light exposure spectrum in accelerated testing to match that of actual sunlight. There have also been great strides made in quantifying actual moisture levels outdoors in benchmark climates, such as Florida, to implement those same levels of moisture in the accelerated testing. Both of these advancements have been captured in newer testing standards, such as ASTM D7869, in pursuit of increased correlation between the laboratory and real life benchmark conditions," he says.

#### **Faster evaluation**

Alessandro adds that increased correlation is not the only requirement in testing development. The need to obtain durability data faster in an effort to increase R&D efficiency is also a priority. Accelerated weathering and real time outdoor weathering are often the longest lead time testing methods for new product developers and are, therefore, the limiting factor for R&D project schedules. He says it is not uncommon for accelerated testing to take several thousands of hours or even greater than 10,000 hours for highly durable materials. Considering that many product developments require

![](_page_48_Picture_5.jpeg)

iterations of testing or may expose a failure along the way that requires retesting, it is easy to see how projects could extend for several years.

However, he says alternative accelerated weathering technologies can present options for higher speed testing. "Spectral light improvement to matching the solar spectrum in accelerated testing now offers greater ability to run xenon testing at higher irradiance levels without risk of exposing materials to high dosages of severe lower wavelength UV light that is not present in the real world. Such higher irradiance testing can reproduce given amounts of light energy in a shorter duration," Alessandro says.

"Furthermore, alternative light source technologies, such as metal halide and mercury vapour lamps, can offer irradiance levels much greater than that of more traditional xenon and fluorescent Above: Avery Dennison operates an extensive accelerated weathering testing laboratory

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Right: Impact Solutions offers an accelerated weathering testing service to SAE J2527 for exterior automotive materials light exposure technologies. These techniques provide the opportunity to accelerate the testing beyond traditional rates of exposure, though care must be taken to verify that the level of correlation to the traditional methods and real-world ageing is maintained," he adds.

"A key aspect to material durability evaluation is performing real time outdoor exposures. Although this can be a time-consuming process that takes years to complete, it is the most valuable and representative data for understanding real world material performance. There are technologies available that combine outdoor weathering with accelerated testing by means of solar tracking devices and mirrors to concentrate the natural sunlight on the sample to increase the rate of exposure. This provides exposure to actual sunlight and real life conditions in an accelerated manner, but the results may still vary from the real time exposures based on long term differences in temperature and moisture cycles."

Alesandro says that Avery Dennison develops products with the customer's requirements in mind and so includes performance criteria such as ease of application and adhesion to complex geometry, and film removability for non-permanent applications in addition to long-term weathering resistance and colour retention. Sustainability is also part of new product development.

When studying product durability, it is essential to understand the material sensitivities and types of failure modes a material will exhibit, the company says. In order to achieve this, various case studies have been investigated to characterise product performance in many climates. This data highlights the effect of environmental conditions such as light exposure, temperature and moisture on the physical properties and colour retention of these films. Moreover, these studies show the importance of understanding the details of the specific applications. Factors such as angle of application and compass orientation play a critical role in determining the amount of light exposure and temperature range a product will see, and ultimately, its durability. Further, the level of care, such as frequency of washing, and even the types of cleaners used, also plays a role in the product durability.

Innovative product development will continue to be the focus moving forward with key initiatives around advancing UV stability and weathering resistance. "Customers continue to demand higher durability in all regions, including those with challenging environmental conditions," says Alessandro. "Along with performance enhancements, sustainable product offerings and launching

![](_page_49_Picture_7.jpeg)

new colours and specialised appearances will continue. In parallel, advancements to accelerated weathering methods are being developed to allow for more advanced evaluations of new products by statistical-based approaches combined with a deeper understanding of polymer degradation mechanisms. This is driving faster and more accurate durability modelling techniques along with enhanced R&D efficiency."

#### **Testing options**

Independent testing laboratory **Impact Solutions** has developed an accelerated weathering testing service to standard SAE J2527 for exterior automotive materials. The UK-based company says it operates several Q-Lab Q-Sun xenon arc weathering chambers within its accelerated weathering laboratory, carrying out test programmes conforming to a range of accelerated weathering standards. Specimens are prepared for the xenon arc chambers and placed on a tray where they undergo specifically designed programmes to mimic weathering conditions. Distance from the light source is a major factor in the amount of irradiance received and the surface temperature of the sample.

Impact Solutions says that SAE J2527 is particularly specific as to what test conditions are used, recreating the effects of direct sunlight, temperature and/or moisture. Temperature, humidity, spray, light and dark cycles are also used to simulate outdoor weathering conditions under SAE J2527. The test programme has a duration of 3000 and 6000 hours.

#### **CLICK ON THE LINKS FOR MORE INFORMATION:**

- > www.atlas-mts.com
- > www.q-lab.com
- > www.averydennison.com
- > www.impact-solutions.co.uk

![](_page_50_Picture_0.jpeg)

![](_page_50_Picture_1.jpeg)

![](_page_50_Picture_2.jpeg)

![](_page_50_Picture_3.jpeg)

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# Exhibitor highlights from 2019

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![](_page_51_Picture_8.jpeg)

K2019 saw a greater participation from foreign visitors and an unmistakable focus on sustainability - including many variants on the theme of recycling plastics

# K2019: wrapping up the big event

The show is over - the plastics industry's global technology showcase will not return to the Dusseldorf showground in Germany for another three years (dates for the next K fair have already been set for 19-26 October 2022). However, whether you were among the 224,116 people that attended this year's event or one of those that did not, there is still plenty to digest in terms of innovation.

Over the following 11 pages we highlight some of the materials and machinery product novelties that caught the attention of our editors. This product review follows on from our show news coverage in the November edition of *Compounding World*. If you missed that you can catch up **HERE**.

## **Polymers and additives**

**Brüggemann** presented its Bruggollen M series reactive chain modifiers for recycling of polyamides. The additives are said to allow precise and reproducible adjustment of relative viscosity at relatively low addition levels, producing "upcycled materials" with performance similar to virgin alternatives.

GE: BRÜGGEMANN GE: BRÜGGEMANN Bruggollen TP-M1417 is a chain shortener that allows high viscosity polyamide waste from film or cast nylon production to be modified for applications such as injection moulding in one extrusion pass. Bruggollen M1251 is a chain extender that can compenLeft: Bruggollen additives from Brüggemann enhance the recyclability of PA **Right:** Clariant's **CESA-Protect** oxygen scavenger targets sensitive beverage packaging

sate for polymer degradation caused by previous processing history. Both are supplied as dust free polymeric granules suitable for accurate metering and are said to be easy to process and disperse. > www.brueggemann.com

Clariant may be in the process of selling its masterbatch and pigments business but it has not put developments on the back burner, especially in the areas of recycling and sustainability. Speaking at the show, Clariant Head of Business Unit Masterbatches Bernd Hägermann said the company had decided to invest in a mini-recycling line that will be installed at its plant at Pogliano in Italy to develop products for the recycling industry. "We aim to emulate all the steps in recycling. The purpose - to get customers to develop projects with us," he said.

Examples of products focused specifically at the recycling sector include CESA-IR additive masterbatches that are sortable using near-infrared (NIR) sorting technology and an extensive range of chain extenders, odour absorbers, and colour brighteners.

The company also introduced the CESA Protect oxygen scavenging masterbatch for use in PET packaging for sensitive products such as fruit juices. CESA ProTect is activated after processing and Clariant claims it is one of the most effective oxygen scavengers for PET on the market. The company says trials of a 23g 0.5-liter bottle with a 3.6% loading of CESA ProTect masterbatch held oxygen levels below 1 ppm for more than 18 months.

In its Pigments division, Clariant now offers a full range of NIR-sortable black pigments covering commodity and engineering resins. These include Solvaperm Black PCR polymer-soluble dye for colouring PS, PET and PC, Graphtol Black CLN pigment for PE and PP, and Polysynthren Black H for PC, PMMA, ABS, PS, PET and PA.

colour matching technology to simplify recycling of

![](_page_53_Picture_8.jpeg)

![](_page_53_Picture_10.jpeg)

Above: Exxtral PP BMU046x grades from ExxonMobil are pitched at the lightweight, brightly coloured automotive interiors of the future

![](_page_53_Picture_12.jpeg)

post-consumer resins. "Recyclates are inherently variable and this makes it difficult to colour-match. We've worked with Konica-Minolta and its Calibri software to develop an easy way to colour-match PCR," he said. "We usually get a colour match in three shots."

#### > www.clariant.com

Cromex launched a new high tinting capacity line of black masterbatches based on carbon black recovered from used car tyres. The Brazilian company said its rC-Black line of masterbatches can be used in applications ranging from packaging through to automotive. Grades are offered suitable for resins including PE, PP, PET, PS, ABS, SAN, PBT and POM.

Cromex says that, as each tonne of rC-Black masterbatch uses 250 end-of-life tyres, it can make a considerable contribution to meeting sustainability goals. Performance is not compromised, the company claims. "Contaminant control is so rigorous that it does not interfere in the masterbatch or final product manufacturing process," said Cromex Product Specialist, Giovanni Dias. Key claimed features include good dispersion, strong colour intensity and high tinting power. > www.cromex.com.br

**ExxonMobil** presented a new low density Exxtral PP compound family for automotive interior trim parts that displays enhanced colourability, offering car makers the opportunity to meet weight reduction targets while adopting more colourful interiors.

"The concept came together as we thought about the cars of the future - connected vehicles, autonomous vehicles, automated vehicles. As those emerge, we think car design will change away from blacks and beiges - with are designed not to distract the driver - to colours," said Andy J West, PP Global Marketing Manager for ExxonMobil's PP, Vistamaxx and Adhesion business.

Exxtral BMU046x grades combine an optimised base PP polymer with no or reduced talc addition to provide up to 10% lower density than traditional compounds used in door panel applications while maintaining resistance to impact, UV and scratching. They are also said to offer reduced odour emissions and a 50% improvement in flexural modulus.

"As well as compounding - which our competitors can do - we have pushed the properties of the polymer that is going into the compound," West said.

The new PP offers a high melt flow, which allows the development of thinner parts, while also making it easy to colour at the machine. This will be important if car makers do adopt a broader range of interior colours, according to West. "For the converter, they only have one material on-site and colour at the press," he said.

To this end, ExxonMobil worked with Clariant to develop a range of vibrant masterbatch colouring options that have been tested in a production environment by French automotive Tier One Plastivaloire (PVL).

West says the new grades will compete against both filled and unfilled PPs. However, he said first applications are expected in filled applications where existing tooling can be used with minimal modification. Unfilled applications will require new tooling to maximise weight saving opportunities. > www.exxonmobil.com

**Hexpol TPE** showed its Dryflex Circular products, a range of performance TPEs developed with recycled content to meet growing market demand from end-users for materials that support their efforts to adopt Circular Economy concepts.

The Dryflex Circular range is structured into different series based on the recyclate source. Currently this includes two lines, which are based on either post-industrial recyclate (PIR) or post-consumer recy-

![](_page_54_Figure_8.jpeg)

clate (PCR). The materials are available in a range of hardnesses from 40 Shore A, and with recycled content up to around 80 wt%. PCR grades are currently only offered in black but PIR grades are available in natural and can be coloured. > www.hexpoltpe.com

**Milliken** introduced its Keyplast Resist line of high performance colorants for engineering plastics at the show. The new product line is aimed particularly at PA – including 6, 66 and 46 types – but can also be used effectively with other high temperature resins such as polyimides, PBT, PPO and PEEK.

0

The colorants are suitable for use with unfilled, glass reinforced and flame retardant compounds. The colour range includes orange, yellow, red, blue and green and the new products are said to offer good weathering resistance and light fastness and

withstand exposure to high temperatures.

"Keyplast Resist meets the strong requirements in another fast-growing application area-that of electrical vehicles and their charging system requirements," said Sami T K Palanisami, Milliken Global Product Line Manager, Plastic Colorants.

The company also unveiled the latest addition to its DeltaMax line of performance modifiers for PP. DeltaMax 5000a is a reactive extrusion additive that is aimed at PP resin producers. It is claimed to allow flow and impact resistance to be improved without compromise in terms of stiffness. The new additive already carries FDA food contact approval with EU approval in progress.

The latest version of its Millad NX8000 series clarifier - NX8000 ECO - was also introduced at the K show. It is targeted at the European market and offers tuneable clarity, fast production rates and reduced migration. The company says the new grade also offers consistent performance under retail lighting conditions. > www.milliken.com

MOL Group launched Tipplen R 665 Clear, a new random PP resin for extrusion blow moulding applications modified with Milliken's NX8000 E clarifier to provide high clarity with low haze and yellow index. The new grade is suitable for all bottle types and can be processed with up to 30% recycled material without loss of clarity. The company says Tipplen R 665 Clear is expected to replace PET, PVC or PC in high clarity packaging applications.

Above: KeyPlast Resist colorants from Milliken are designed for high temperature ETP applications

IMAGE: MILLIKEN

Left: Tipplen R665 Clear is a clarified PP for EBM containers from Hungary's MOL Group

IMAGE: MOL GROUF

**Radici Group**'s High Performance Polymers business launched Radilon Nextreme, a new line of easy-to-process performance polyamides capable of long term operation in air up to 230°C. Three grades are available. Radilon NeXTreme RV350HHR 3800 BK is a 35% glass reinforced product and RV500HHR 3800 BK is 50% glass reinforced. Both are intended for injection moulding. The third grade – HSW 100 NT – is intended for technical filament production.

The two moulding grades are primarily aimed at automotive applications such as air intake components. Radici said they offer better chemical resistance and lower absorption than PA66 alternatives. The ability to process the grades in water-cooled moulds is a benefit over PPA, according to the company.

Nicolangelo Peduto, Global R&D and Product Innovation Manager at Radici High Performance Polymers, said the new grades are a combination of polymerisation and compounding enhancements and take advantage of the company's in-house polymerisation capability. "Acting on the polymer chain is a key way to enhance the polymers for applications that are more and more aggressive," he said.

Radici said the company would be adding more grades to the Nextrem portfolio, with the electronics industry a key target market. Potential opportunities include the substitution of thermosets in high temperature applications such as lead-free soldering. **> www.radicigroup.com** 

Below: The Stajvelo cycle frame and wheels are injection moulded in Solvay's Xencor Para LFT **Sibur** said that its 2m tonne/yr capacity ZapSib PP facility at Neftekhim in Russia is now producing test volumes and is on track to near triple its polyolefin capacity to 3.24m tonnes of PE and PP polymer by 2020. That, however, could be further expanded to reach 5.5m tonnes by 2024 if it goes ahead with a proposed joint venture with Gazprom that would include up to 2.7m tonnes of new PE and PP

![](_page_55_Picture_7.jpeg)

capacity at Svobodny. A decision on whether to go ahead with that investment, which would make Sibur the largest PE and PP producer in Europe, will be taken in the next few months, the company said. **> www.sibur.ru** 

**SI Group** presented its Ultranox LC platform of antioxidants, which are designed to improve colour control in processing of polyolefins, as well as previewing a new solid antioxidant system.

According to New Business Development Manager Ron Becker, the bigger and faster extrusion systems being used today place a much greater thermal loading on the resin and stabilisation package. This can result in perceptible yellowing (he said the average person can detect a difference of 1-2 yellow index units).

Ultranox LC is based on an already-approved food additive so the company is confident it will successfully achieve FDA and EU food contact approval. It acts as a non-conventional antacid and is said to outperform the company's long established Ultranox 626 in all respects except melt flow control.

Three LC grades will be available initially: LCPP301 is a fully formulated stabiliser package; LCPP501 is intended for fibre production; and LCPP701 is formulated for production of stearatefree BOPP films.

The company also previewed what it described as a "next generation solid antioxidant" to replace AO1010, AO-168 and phenolics. It claims its new system offers comparable economics with better colour stability at a lower loading level (down from 1,500ppm to 1,170ppm).

Global Business Development Director Polymer Additives Martin Pavlik said the new additive could benefit polymer producers looking to make their PE and PP products more recyclable without adding more extractable content. He said the company hopes to bring first grades to the market within three years.

#### > www.siigroup.com

**Solvay** introduced KetaSpire PEEK XT, a new high performance polymer claimed to offer the chemical resistance of traditional PEEK grades together with a 20°C improvement in Tg and 45°C increase in melt temperature, supporting high temperature applications requiring high strength and stiffness.

"We were able to boost thermal and mechanical performance while maintaining PEEK's ether-toketone ratio, which accounts for the polymer's superior chemical resistance," said Doug Brademeyer, Ultra-Polymers Business Manager for Solvay's Specialty Polymers global business unit.

# LSR Innovations Düsseldorf / 2020

Exploring the fast-developing market for LSR components

4 - 5 March 2020 Crowne Plaza, Düsseldorf - Neuss, Germany

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![](_page_57_Picture_2.jpeg)

**Above: Technyl** Orange compounds meet the needs of high voltage **EV electrical** connectors

"The trick is that it is a true PEEK but we have been able to add more aromatic structure."

Brademeyer explained that a "true PEEK" polymer has a 2:1 ether-to-ketone ratio, pointing out that it is the ether component that delivers the chemical resistance. Other high-temperature polyketones, including polyetherketone (PEK) and polyetherketone ketone (PEKK) alter this ratio with an associated loss of performance, he said.

KetaSpire PEEK XT polymer has a glass transition temperature of 170°C and processes as standard PEEK but at a 20°C (36°F) higher melt temperature. The material displays a 400% higher tensile modulus and near 50% higher tensile strength at 160°C than traditional PEEK grades. It also displays a 50% improvement in dielectric strength and volume resistivity at 250°C.

The new polymer is available globally in unreinforced as well as 30% glass and 30% carbon fibre reinforced granular and powder grades. Brademeyer says price is "incrementally higher than the market price for PEEK but is far lower than PEK and PEKK."

The company also updated on its high performance LFT materials, where it sees considerable future opportunity. Global LFT Manager Eric Martin said the company had made considerable progress in integrating the LFT technology it acquired through the purchase of EPIC Polymers in 2015 with its pre-existing high performance polymers.

"Since the beginning, the goal of the acquisition was to differentiate ourselves in the world of long fibre compounds and to extend in to high temperatures," Martin said. "If you look to high performance applications, people are more and more trying to replace metal and most applications that can be filled with short fibre have been. LFT bridges the gap."

At the show, the company displayed an electric cycle produced by Stajvelo that uses its Xencor Para polyacrylamide LFT to produce the frame and wheels. The three parts together weigh just 9kg

and display a very good surface finish (a particular benefit of the Para polymer matrix). The cycle on display was painted but Martin said no surface preparation was needed aside from degreasing.

Solvay aims to develop LFT materials based on matrix resins from across its high performance polymer portfolio, Martin said, adding that an LFT grade based on Ryton PPS is already available to customers on a pre-commercialisation basis. > www.solvay.com

Solvay Performance Polyamides introduced its Technyl Orange family of compounds for production of high voltage electrical connectors and components in electric vehicles. The products are flame retarded, resistant to high temperatures and offer very good colour retention.

"In powertrain electrification systems, any live parts carrying more than 30 V AC or 60 V DC are a potential electric shock hazard. These parts must be instantly recognisable to alert production line employees, after-sales personnel and car owners," said Hubert Ruck, Global Director New Mobility for the company.

The new materials are available coloured to RAL 2003 for Europe and RAL 2008/2011 for the US. They are halogen-free grades based on Technyl One and Technyl Star formulations and offer UL94 V-0 down to 0.4mm in some cases.

Solvay is in the process of selling its Performance Polyamides unit to BASF as part of a deal that sees Domo Chemicals acquire the European PA66 activities, including the Technyl business.

#### > www.technyl.com

Songwon - best known for its stabilisation and anti-oxidant products - announced a move into the fire retardants sector with the introduction of the SongFlame line of flame retardant synergists.

Stating the company's intention to become a "driving force in flame retardants," Songwon Board Member Dieter Morath said the new additives can considerably lift performance and improve cost effectiveness as part of phosphorous flame retardant systems. "With additions of 0.5-2.0% we can reduce the phosphorous content so the cost can be reduced and the physical and mechanical properties improved," he said. "And if you do not want to take the economic benefit then the phosphorous system can go to higher performance levels."

The SongFlame products are said to be suitable for use with a wide range of polymers, including polyolefins, ABS and TPUs. >

> www.songwon.com

# **Polymers in Footwear** Portland / 2020

Capitalizing on advances in polymer materials and processing technologies for footwear applications

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## **Machinery and equipment**

Right: C-Beyond is Coperion's new app-based plant management offering Accrapak Systems showed the latest version of its ASL Heavy Duty pelletiser, which offers tool-free access and improved cutter and chute safety interlocks to allow a complete colour and roll changeover in five minutes.

The machine on display was an ASL 300 model, which offers a 300mm feed width and maximum throughputs of up to 3,200 kg/hr depending on product density. Standard features include dual drives to power the rotor and feed roll, which allows pellet length to be adjusted down to 1mm and to be maintained independent of line speed changes, and fixed roller gap setting. Sales Engineer Graham Pennington said the machines also feature a straight feed table, which allows them to handle soft materials as well as heavily loaded glass reinforced polymers.

> www.accrapak.co.uk

**Coperion** presented an updated version of its proven ZSK compounding extruder design, which includes several new features to help users run more efficiently and reduce downtime, and previewed its next generation control and monitoring systems.

The machines on show included ZSK 45 Mc<sup>18</sup> and ZSK 70 Mc<sup>18</sup> variants. Both included a new one-piece cover design that can be detached for cleaning without interfering with the heaters. Access to the cartridge heaters is also improved – they can now be replaced individually and quickly connected via IP67 plugs.

The gearbox lantern has also been modified on the new machines to allow tool-free access to the shaft coupling as soon as the machine has stopped for maintenance. The ZSK 45 Mc<sup>18</sup> on display was also fitted with flanged barrels rather than the previous tiebar arrangement.

While convinced of the performance benefits of the new machines, Coperion Business Unit Head Peter von Hoffmann said the company's major focus in recent times has been on software innovations such as the newly introduced C-Beyond digital control suite.

"Slowly these machines are getting more and more mature. We have to provide a cutting edge by being smarter - saving a few minutes or seconds," he said, adding that there had been a very good reception from the market to the new C-Beyond development. "There has been a lot of interest, especially from customers that have a lot of machines from us. Over the last three years this

![](_page_59_Picture_11.jpeg)

was a vision, now it is a solution."

C-beyond is intended to connect equipment and simply display the key KPIs. Aimed at plant managers rather than operators, the app-based system takes data from each machine controller and can combine that with cloud data to provide real-time OEE information. Coperion is also in the final stages of adding a customer-specific parts ordering module and intends to include product catalogues for registered users.

The company also showed a preview of a new machine interface that it hopes to begin rolling out across its machine line through 2020. This is intended to present a more uniform window into the machine but will also include a number of smart features such as maintenance planning, step-bystep troubleshooting, improved process monitoring, and general productivity tools such as feeder sequencing (which will allow feeders to be run down ahead of a product changeover).

> www.coperion.com

**Fimic** showed its latest and largest melt filter. The GEM model uses two 600mm diameter screens to provide 5,500cm<sup>2</sup> of filter surface and is intended for use in high volume and highly contaminated recycling applications.

"All customers are increasing capacity and output and are handling more and more different materials with more contamination," said Fimic Sales Director Erica Canaia, who explained that the unit can process up to 3 tonnes/h depending on the application.

The new machine, which can be equipped with

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**Plastics Recycling** 

**Right: New** covers on the latest ZSE iMaxx extruder from Leistritz hide many design improvements

laser screens from 80-300 microns and mesh screens from 400 to 2.000 microns. combines the twin filters with two scrapers and two independent discharge valves that function automatically. For maximum flexibility in operation, the unit can be set to scrape and discharge at a predetermined pressure or, where high levels of contamination are being handled, to scrape continuously and discharge.

Main applications for the GEM are envisaged for LDPE, LLDPE, HDPE and PP processing but the units can also handle resins such as PS and ABS, as well as EPS.

Canaia said the company is putting the GEM model through its paces at an extrusion machinery producer's site with a full market launch expected next year.

#### > www.fimic.it

KraussMaffei announced the upward extension of its ZE BluePower twin screw compounding extruder range with the launch of four new models with 98, 122, 142 or 166mm diameter screws and torque density of up to 16.5 Nm/cm<sup>3</sup> (up by 35% on the company's previous offerings in this size range.

The company says the new machines are designed for large national and international compounding companies with high production capacities where maximum reliability in 24/7 operation is a must. Maximum production outputs range from 2,500 to 12,500 tonnes/h.

Gearbox and drive efficiency is a claimed 98%. "The usual in the market is 96%," said Nicolas Beyl, President of the KraussMaffei Reaction Process Machinery Segment, who introduced the new machines to the media at the show. "That's a small difference but in a year of production it's a lot."

From a process-engineering standpoint, the four large machines are identical to the smaller models

![](_page_61_Picture_10.jpeg)

![](_page_61_Picture_11.jpeg)

www.compoundingworld.com

Leistritz

IMAGE: LEISTRITZ

heaters.

in operation.

> www.kraussmaffei.com

so consistent scale up is ensured. The

larger extruders also offer the same screw

and barrel modularity together with a wide range of

4D and 6D barrel sections and various side feeder

new models; housing elements are now connected

by screw unions rather than clamping flanges while

Leistritz unveiled a heavily redesigned version of

its ZSE iMaxx twin screw compounding extruder.

Presented in a 27mm version, the new design will be implemented on 18, 27, 35, 40, 50 and 60mm

models and is intended to provide greater flexibil-

ity in terms of specification and to be more efficient

The most noticeable change is in the machine cover, which is manufactured in stainless steel and

latter has also been upgraded in terms of volume).

This is intended to minimise any contamination of

the work area and is expected to prove particularly

attractive to masterbatch producers, who typically

However, the new machine design includes a

number of other significant changes. Access to the

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

carry out a lot of job changes and clean-downs.

water manifold has been improved (and water

barrel can now be fully insulated.

covers the barrel as well as the side feeder (the

and degassing units. A number of small design

changes have been made due to the size of the

ceramic heaters are used in place of cartridge

SHOW REVIEW | K2019

IMAGE: PROTEC POLYMER PROCESSING

meets their specific needs. For example, a torque measurement option can be built-in to all machines from 35mm diameter up, and vibration and oil quality sensors can be fitted to help develop a planned maintenance programme. Leistritz can also integrate its in-line rheometer to provide on-line and closed loop control.

#### > www.leistritz.com

**Maag** presented a glimpse into the strand pelletiser of the future with the display of the Primo FC, which it described as a case study that addressed many key priorities of compounders in today's highly competitive environment, including fast clean-down and speedy product changeover.

Features of the machine include push-button powered opening, swing-away access to the bed knife, convenient cutter gap adjustment from the rear, quickly-detachable outlet, and an integrated lift mechanism for removal of the rotor. Maag Automatik General Manager Harald Zang said customers should expect to see some of these features implemented on Primo machines in the future.

The company also presented an updated version of its Primo 100E pelletiser. Originally

![](_page_62_Picture_7.jpeg)

targeted at masterbatch applications, where the single-sided bearing design allows fast clean-down and job change, the unit is now being targeted at compounding operations. It is said to offer outputs of up to one tonne per hour when running glass reinforced resins.

The machine on display was shown with Scheerdimensioned cutters. Zang said the option to specify a machine at the point of purchase to take the 200mm diameter Scheer rotor rather than the 162.5mm diameter type used by Automatik is part Above: Protec's latest LFT production lines offer an up to 60% increase in line speeds

#### **NEW REPORT**

### PP Compounds in Europe 2019

Of central importance to the profitability of PP Compounds are the strategies and motivations of the principle sellers and their market ambitions.

This report investigates and reviews these strategies and discusses market threats and opportunities.

#### **FIND OUT MORE**

## Netting the benefits of recycling

A project to recycle waste fishing ropes and nets in Chile was showcased by ExxonMobil, which provided its expertise and Vistamaxx material for the Atando Cabos (literally tie rope) scheme.

Established in 2017 by plastics industry executives Francisco Cruz and Julio Compagnon, who are both directors of Chilean recycling and injection moulding company Comberplast, Atando Cabos began with a collection system for ropes and used fishing gear run by local communities in the Chilean Patagonia region,

![](_page_63_Figure_4.jpeg)

Returnable crates produced by Comberplast from recycled PE/ PP fishing gear using ExxonMobil's Vistamaxx compatibiliser

on the southern tip of South America. These communities see the collection work positively, said Cruz, ensuring confidence of a steady supply. The reprocessing obstacle that had to be addressed was that the waste was an incompatible mix of PE and PP, which was overcome by ExxonMobil with its Vistamaxx compatibilising additive. The initiative is now successfully producing a recycled PE/PP compound that is being used to injection mould robust 1.3kg crates for transit packaging in various end markets - one customer is using the crate in the Netherlands in the flower trade, for example.

Since the project began, 1,200 tonnes of the PE-PP compound have been produced. Cruz said the company is targeting an annual production rate of 2,000 tonnes, with the aim of selling the compound into the international market.

www.atandocabos.cl
www.exxonmobil.com

Sustainability was very much the theme for K2019. You can find more news about the key recycling developments in the **latest edition** of our sister publication Plastics Recycling World.

of its process of range standardisation. Customers can, however, still buy a full-Scheer design.

The company also previewed the Gala Color & Pellet Control system, which uses technology developed by Cologne, Germany-based ROC (Rapid Optical Control), the latest addition to the Maag Group that was acquired just before K began. Combining colour control, colour dosing and automatic sampling in a single system, it is intended to improve colour management and quality control in plastics extrusion, compounding, and recycling applications.

"It measures the colour and the pellet specification on the fly," said Michael Eloo, General Manager of Maag's underwater pelletising systems business. "You measure every individual pellet so if you have any problems with your process you will see it." > www.maag.com

/ .....

**ProTec Polymer Processing** detailed an upgrade for its LFT compounding lines allowing production rates to be increased from 30 to 50 m/min without loss of pellet quality or physical performance.

According to Karin Luxem, Area Sales Manager Asia Pacific for the company's LFT production systems, the move responds to a clear demand from customers - particularly those producing PP-based LFT compounds - for higher production outputs and reduced manufacturing costs.

Luxem said achieving the gain without sacrificing quality required a full redesign of the production technology. "The key issue is to coat each individual filament so you pull the polymer off the fibre. If the coating is not good enough you lose performance," she said. "You have to control each single part of the line to get the quality - one key element is the die but it is not the only element. The key change in high speed production is the handling of the fibre in front of the die."

The new system includes redesigned fibre pre-heating, an improved die, enhanced cooling, and an upgraded puller and pelletiser. The software control has also been updated to provide fully intelligent "balancing" of each section of the line for changes to pellet length or line speed.

Most Protec LFT lines are producing PP-based glass reinforced compounds. However, the equipment can handle PA 6 and 66, POM, PC, PPS and renewable polymers such as PLA while reinforcement options include carbon, aramid and steel.

> www.sp-protec.com

# Download these new product brochures

Simply click on the brochure cover or link to download a PDF to your PC or smartphone

#### **KK KOMPOUNDING: COMPOUNDS**

![](_page_64_Picture_3.jpeg)

This 16-page brochure details the compounding capabilities of India's KK Kompounding Tech Giant (Technovinyl Polymers), which produces a variety of TPEs and TPVs, TPU alloys, engineered PP compounds and halogenfree cable compounds.

#### CLICK HERE TO DOWNLOAD

#### **COPERION: FEEDING TECHNOLOGY**

![](_page_64_Picture_7.jpeg)

Coperion K-Tron provides a full portfolio of feeding and conveying equipment for compounders. This 16-page brochure details the full range, from volumetric and gravimetric feeders to blenders and metering units.

CLICK HERE TO DOWNLOAD

(coperion

#### **CPM EXTRUSION: SYSTEMS AND PARTS**

![](_page_64_Picture_11.jpeg)

This new brochure from CPM Group details the extended range of compounding extruders, production lines and replacement parts available from the company following its recent acquisition of Germany-based Extricom.

CLICK HERE TO DOWNLOAD

#### LEISTRITZ: MASTERBATCH SYSTEMS

![](_page_64_Picture_15.jpeg)

Additive and colour masterbatch production places specific demands on compounding equipment. This 16-page brochure from Leistritz explains how its ZSE 35 iMAXX masterbatch twin screw extruder rises to the challenge.

> CLICK HERE TO DOWNLOAD

#### POLIMER TEKNIK: POEX EXTRUDERS

![](_page_64_Picture_19.jpeg)

Polimer Teknik's POEX range of co-rotating twin screw extruders are versatile machines suitable for processing compounds ranging from ETPs to TPEs, as well as colour and additive masterbatches. This brochure details the key features.

#### CLICK HERE TO DOWNLOAD

ARKEMA: RECYCLING SOLUTIONS

![](_page_64_Picture_23.jpeg)

This brochure from Arkema introduces the Lotryl, Lotader and Orevac materials, which improve the mechanical recycling performance of post-consumer waste when used in plastic compounds, meeting sustainability requirements.

**CLICK HERE TO DOWNLOAD** 

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

# Learn more about AMI's upcoming conferences

Click on the relevant brochure cover or link to download a PDF of the full conference programme

#### **THERMOPLASTIC CONCENTRATES 2020**

![](_page_65_Picture_3.jpeg)

Now in its 23rd year, Thermoplastic Concentrates is the learning and networking destination for the North American concentrates (masterbatch) market. The 2020 event takes place in Ft Lauderdale, Florida, USA, on 28-30 January 2020.

#### **PIPELINE COATING 2020**

![](_page_65_Picture_6.jpeg)

AMI's 12th Pipeline Coating conference takes place in Vienna in Austria on 11-13 February 2020. This well-established international conference examines the latest developments in pipe coating materials and application technology.

> CLICK HERE TO DOWNLOAD

![](_page_65_Picture_9.jpeg)

CLICK HERE TO DOWNLOAD

#### **PVC FORMULATION EUROPE**

Taking place in Cologne, Germany, on 24-26 February 2020, AMI's 12th PVC Formulation conference will expose the global trends influencing the flexible and rigid PVC industry and explore regulation, additives, materials and processing.

#### MASTERBATCH ASIA

![](_page_65_Picture_13.jpeg)

The 16th Masterbatch Asia conference takes place in Bangkok in Thailand on 3-5 March 2020. Returning to its three-day format, the conference will examine the challenges and opportunities for the industry in this demanding regional market.

> CLICK HERE TO DOWNLOAD

#### **CABLES 2020**

![](_page_65_Picture_17.jpeg)

**CLICK HERE TO DOWNLOAD** 

AMI's 20th Cables conference takes place on 3-5 March 2020 in Dusseldorf, Germany, providing a forum to learn about the latest materials, testing procedures, regulatory requirements and cable manufacturing processes and applications.

#### SINGLE-SERVE CAPSULES USA

![](_page_65_Picture_20.jpeg)

The 3rd edition of AMI's international Single-Serve Capsules conference in North America, on March 3-4, 2020 in Austin, Texas, brings together industryelite speakers to evaluate and discuss the trends, challenges and opportunities facing the sector.

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## To see our full line-up of more than 50 plastics industry events over the next 12 months, please visit www.ami.international/events

# Learn more about AMI's upcoming conferences

Click on the relevant brochure cover or link to download a PDF of the full conference programme

#### LSR INNOVATIONS

![](_page_66_Picture_3.jpeg)

AMI's LSR Innovations conference returns to Neuss, near Dusseldorf, in Germany on 4-5 March 2020. The event brings together materials and processing technology experts, processors and end-users to explore the latest LSR solutions and trends.

#### PLASTICS REGULATIONS EU

![](_page_66_Picture_6.jpeg)

The 4th edition of Plastics Regulations provides advice on a range of compliance issues at one event. The event takes place on 11-12 March 2020 in Cologne, Germany. The conference provides an ideal environment for regulatory updates.

CLICK HERE TO DOWNLOAD

# Artificial Grass **CLICK HERE TO DOWNLOAD**

The 14th Artificial Grass the future for the synthetic

#### **PVC FORMULATION USA**

![](_page_66_Picture_12.jpeg)

The 2020 edition of AMI's North American PVC Formulation conference will be held in Cleveland, Ohio, USA, on 24-25 March 2020, providing a forum for formulators, compounders and suppliers to identify future material and processing trends.

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#### FIRE RETARDANTS IN PLASTICS

![](_page_66_Picture_16.jpeg)

The 10th edition of AMI's Fire Retardants in Plastics conference moves to Cleveland, Ohio, USA. Taking place on 31 March-1 April, the event explores the regulatory and technical developments shaping the North American fire retardants market.

#### **POLYMERS IN FOOTWEAR USA**

![](_page_66_Picture_19.jpeg)

The second edition of AMI's North American Polymers in Footwear conference takes place in Portland, OR, USA, on 7-8 April 2020, presenting a comprehensive analysis of the latest advances in footwear materials and processing technologies.

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#### To see our full line-up of more than 50 plastics industry events over the next 12 months, please visit www.ami.international/events

#### **ARTIFICIAL GRASS**

conference (formerly the Grass Yarn and Tufters Forum) takes place in Barcelona in Spain on 23-25 March 2020. The event examines technical and commercial developments shaping turf industry.

# Optimise your industry knowledge with AMI's recommended databases

#### Compounders and Masterbatch Producers in Europe

![](_page_67_Picture_2.jpeg)

**CLICK HERE** 

Identify 700 manufacturing plants producing compounds and masterbatches in Europe. This unique insight into the industry provides full contact and production details for each site.

#### Compounders and Concentrate Producers in North America.

![](_page_67_Picture_5.jpeg)

Find out about the latest developments in the compounding industry in the United States, Canada and Mexico. This directory gives key location and production details on all the players.

#### **CLICK HERE**

#### Compounders and Masterbatch Producers in South America

![](_page_67_Picture_9.jpeg)

This database enables you to identify and interact with actual producers of compounds and masterbatches in Argentina, Brazil, Chile, Colombia, Ecuador, Peru, Uruguay and Venezuela.

#### **CLICK HERE**

**CLICK HERE** 

#### Compounders and Masterbatch Producers in China

![](_page_67_Picture_13.jpeg)

The Chinese plastics industry is developing fast, this database will give you the contact and production details of over 600 manufacturing sites in China producing compounds and/or masterbatches.

#### Compounders and Masterbatch Producers in Middle East and Africa

![](_page_67_Picture_16.jpeg)

Find reliable information on key producers of compounds and masterbatches in Algeria, Bahrain, Egypt, Ethiopia, Iran, Ivory Coast, Kuwait, Morocco, Nigeria, Oman, Saudi Arabia, South Africa, Tanzania, Tunisia, Turkey, United Arab Emirates.

#### **CLICK HERE**

#### Compounders and Masterbatch Producers in India

![](_page_67_Picture_20.jpeg)

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.

**CLICK HERE** 

![](_page_67_Picture_23.jpeg)

# Keep informed: read our latest editions

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

![](_page_68_Picture_2.jpeg)

#### Compounding World November 2019

The November 2019 The November edition of Compounding World looks at the sustainability drive in carbon black production, delves into the world of mixing technology and surveys the latest in polymer reinforcements and packaging additives. Plus: news from K2019.

![](_page_68_Picture_5.jpeg)

#### Compounding World October 2019

The October edition of Compounding World goes inside the titanium dioxide market to find out the latest regulatory, technical and market developments. Also featured: 3D printing materials, alternative compounding technology and a K2019 Machinery Preview.

> CLICK HERE TO VIEW

![](_page_68_Picture_9.jpeg)

### Injection World

> CLICK HERE TO VIEW

**November/December 2019** The November/December edition of Injection World takes explores new developments in hot runners and engineering thermoplastics. It also examines some of the latest automotive applications and details innovations on show at K2019.

> CLICK HERE TO VIEW

![](_page_68_Picture_13.jpeg)

#### Pipe and Profile November/December 2019

The November issue of Pipe and Profile Extrusion surveys the latest developments in wood-plastic composites, multi-layer pipes and PEX pipes and investigates methods for reducing wear in extruder screws and barrels. Plus news from K2019.

> CLICK HERE TO VIEW

![](_page_68_Picture_17.jpeg)

Film and Sheet

EXTRUSION

**Plastics Recycling** 

#### Plastics Recycling World November/December 2019

The November-December issue of Plastics Recycling World explores the growing importance of granulators, updates on PVC recycling and reviews the recycling highlights of the K2019 show.

#### > CLICK HERE TO VIEW

#### Film and Sheet December 2019

The December 2019 edition of Film and Sheet Extrusion looks at the latest developments in foamed sheet. It also reviews new introductions in melt filtration, static charge control and granulation equipment, plus some of the best from K2019.

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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.

![](_page_68_Picture_25.jpeg)

#### **GLOBAL EXHIBITION GUIDE**

13-16 January	Saudi Plastics & Petrochem, Riyadh	www.saudipp.com
16-20 January	Plastivision India, Mumbai, India	www.plastivision.org
21-23 January	Swiss Plastics, Lucerne, Switzerland	www.swissplastics-expo.ch
28-31 January	Interplastica, Moscow, Russia	www.interplastica.de
9-11 March	Plast Alger, Algiers, Algeria	www.plastalger.com
11-13 March	Expo Plasticos, Guadalajara, Mexico	www.expoplasticos.com.mx
21-24 April	Chinaplas, Shanghai, China	www.chinaplasonline.com
7-13 May	Interpack, Dusseldorf, Germany	www.interpack.com
3-4 June	Compounding World Expo Europe, Essen, Germany	www.compoundingworldexpo.com/eu/
8-11 June	Argenplas, Buenos Aires, Argentina	www.argenplas.com.ar
29 Sep-1 Oct	Interplas, Birmingham, UK	www.interplasuk.com
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

Plast 2021, Milan, Italy

NPE 2021

2021

2020

4-7 May 17-21 May

#### **AMI CONFERENCES**

28-30 January 2020 Thermoplastic Concentrates, Ft Lauderdale, FL, US 11-13 February 2020 Pipeline Coating 2020, Vienna, Austria 24-26 February 2020 PVC Formulation Europe, Cologne, Germany 3-4 March 2020 Single-Serve Capsules USA, Austin, TX, USA 3-5 March 2020 Masterbatch Asia, Bangkok, Thailand 3-5 March 2020 Cables 2020, Dusseldorf, Germany 11-12 March 2020 Plastics Regulations Europe, Cologne, Germany 24-25 March 2020 PVC Formulation USA, Cleveland, OH, USA 31 March-1 April Fire Retardants in Plastics, Cleveland, OH, USA

www.plastonline.org/en

www.npe.org

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

### PLASTICS RECYCLING WORLD EXPO

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4 - 5 November, 2020 CLEVELAND, OHIO

#### www.ami.international/exhibitions

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Proudly supported by: Compounding WORLD

Plastics Recycling

# Extrusion Solutions

#### THE LATEST EXTRUDING NEWS FROM ENTEK

## **ENTEK Announces** New Health & Wellness **Checks for Twin-Screw** Extruders

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ENTEK has announced a new service from its Customer Support Department, designed to help customers with preventative maintenance for their twin-screw extruders and equipment.

ENTEK

The new ENTEK Health & Wellness Checks service is a combination of critical mechanical health checks, general wellness checks, and other checks including electrical and overall maintenance. This comprehensive examination of customer equipment will extend machinery life and prevent downtime.

ENTEK's recently expanded Customer Support Department (see article on p. 3), led by Darla Bulmer, Customer Support Manager, has implemented this new service. Working with a cross-functional technical team, the Health and Wellness Checks has already proven successful and is the first component in an overall Preventative Maintenance Program.

"We are ready to help our customers avoid the stress and additional costs of unplanned failures and outages," said Darla Bulmer. "Many issues can be detected and avoided through regular checks of systems and equipment, along with a comprehensive check for wear and obsolete parts."

To schedule your Wellness Check or for any questions, contact ENTEK's Customer Support Department at (541) 259-1068 or send an e-mail to ENTEK\_Customer\_Support@entek.com.

![](_page_70_Picture_11.jpeg)

![](_page_71_Picture_0.jpeg)

## Who We Are

Welcome to the latest issue of *Extrusion Solutions*.

![](_page_71_Picture_3.jpeg)

Dr. Kirk Hanawalt

#### 11

The new 'Health and Wellness Checks' program that our Customer Support Department has implemented is a great way to help our customers get the best performance possible out of their ENTEK machinery and equipment

#### A Commitment to Customers

In this issue of *Extrusion Solutions*, you will see some news about what we're doing to improve our overall customer support.

First, we have expanded our Customer Support Department and have hired Darla Bulmer to lead this function at ENTEK (see article on p. 3). Darla is a veteran Customer Support professional who has led teams at General Motors and Hewlett-Packard to proactively support customer needs.

A great example of this – 'proactively supporting customer needs' – is outlined on our page 1 story. The new 'Health & Wellness Checks' program that our Customer Support Department has implemented is a great way to help our customers get the best performance possible out of their ENTEK machinery and equipment. At the same time, it will help them prevent costly downtime issues.

ENTEK is a company that is fully committed to Customer Support. It is an ongoing priority here, and we will continue to do all we can to ensure our customers' satisfaction and success.

#### **Turnkey Manufacturing Plants**

In our last issue of *Extrusion Solutions*, I wrote about how ENTEK stands apart from other suppliers in the plastics industry because we do much more than sell machinery and equipment. A big part of our business is helping customers expand their manufacturing operations.

We have seen tremendous growth in this area, and more and more customers are turning to ENTEK to help them design, build and commission complete plant operations. In fact, in 2019 we have seen some of the biggest orders in our 21-year history from customers looking for turnkey plant support. ENTEK has the experienced technical and support personnel you need to guide your expansion project through to successful completion. Put our expertise to work for you. See the article on p. 3 to learn more about the many ways ENTEK can help you expand and grow your business.

#### **Additional Sales Support**

Lastly, I wanted to write a few words about a long-time ENTEK employee who has recently been promoted to the new position of Sales Engineer (see the article on p. 4).

I hired Al Bailey back in 1995, when he joined our company as a Controls Engineer. Shortly after Al joined ENTEK, ENTEK decided to open its Extruders division. Al was an instrumental part of the team that worked on the design and launch of the first ENTEK Extruder, which was launched in 1998.

For almost 25 years, Al has worked tirelessly to support ENTEK's customers worldwide. In his new role as Sales Engineer, he is a great resource for our sales team and our customers, where his project management and turnkey plant expertise will help fuel our growth and success in this important area.

As always, I encourage you to contact me anytime at khanawalt@entek.com.

Sincerely,

R. Hanawalt

Dr. Kirk Hanawalt President, ENTEK Extruders

,,


# **ENTEK Expands Customer Support Department**



Darla Bulmer

ENTEK is proud to announce it has expanded its customer support department. The company has hired Ms. Darla Bulmer to lead the growing department.

Customer support duties have been handled by ENTEK's sales, manufacturing and engineering personnel in the past, and that will continue to some degree, according to Linda Campbell, ENTEK's Vice President of Sales. But the purpose of enlarging the Customer Support Department was three-fold; 1) it will provide customers with even better support from a larger team of dedicated customer service professionals, 2) it will give the salespeople more time to focus on customers, and 3) it will allow ENTEK to expand the support and services offered to its customers.

"ENTEK has been providing its twin-screw extruders to the industry for over 20 years, and our fleet of machines around the world continues to grow," said Linda Campbell. "Customer support has always been our top priority and the structure of this department is designed to provide even better service to our valued customers."

Darla Bulmer comes to ENTEK from General Motors, where she worked the past six years in global service positions. Prior to that she worked for Hewlett-Packard as a Sr. Technical Lead. She has a strong background in leading teams by establishing processes and procedures that proactively support customer needs. Darla will lead ENTEK's Customer Support Department and report to Linda Campbell in her new position.

In addition to Darla Bulmer, ENTEK's Customer Support Department includes Matt Ramsdell and Toby Daugherty. Matt is a 24-year ENTEK veteran with a background in electrical and controls engineering who has been leading customer support in recent years. Toby recently joined the Customer Support Department after four years of experience with the assembly group at ENTEK, where he has assisted numerous customers with his mechanical knowledge.



# **Turnkey Manufacturing Plants**

ENTEK provides complete, turnkey engineering support to develop and operate highly efficient plants for a wide variety of processes and materials.Our experienced engineering department can assist with every stage of site selection, plant design, and construction. Our turnkey services include the following, and more:

- · Project Management Services
- Engineering Support
- Processing Technology Analysis and Improvement
- Plant Operation Audits
- Complete Plant-Wide Operations Support from the Ground Up

Over 30 years ago, ENTEK began as a turnkey manufacturing plant in Lebanon, Oregon, producing highly-filled sheet for the automotive battery market. This makes us the only twin-screw manufacturer that started out by being a twin-screw user, giving us a unique perspective on designing and running a plant 24/7/365. We truly understand first-hand how important having a reliable supplier is.

Put our many years of experience to work for you. If you are looking to expand your current factory or build an entirely new plant, give us a call today!







New at ENTEK

## **ENTEK Promotes Al Bailey To Newly Created Position Of Sales Engineer**

Effective November 1, long time ENTEK employee Al Bailey has been promoted to the newly created position of Sales Engineer. In this new role he will report to Linda Campbell, ENTEK's Vice President of Sales.

Al, a 1992 graduate of Eastern Washington University with a degree in Mechanical Engineering Technology, has worked at ENTEK since 1995 when he joined the company as a Controls Engineer. At that time ENTEK was only building extruders for use on its own battery separator lines. Al was part of the team that worked on the design of the first ENTEK Extruder for outside sales and was part of the launch of that business at the K fair in Dusseldorf, Germany in 1998.

As ENTEK extruder sales continued to grow, so did the company's Controls Engineering Department, and Al was selected to manage that group. To better serve the company's customers, ENTEK decided to open a satellite office on the east coast in January 2006. Al opened that office in North Carolina, where he has continued to work ever since.

As a Sales Engineer, Al will attend sales calls with Regional Sales Managers to consult on opportunities that involve turnkey services. He will assist with mechanical and electrical quoting for turnkey projects, interviewing contractors, and preparing detailed schedules for entire projects from the engineering phase, through equipment and plant build, installations, start-up and training.

"We are excited to have Al joining our sales department in this new position," said Linda Campbell, ENTEK's Vice President of Sales. "He has almost 25 years of experience and knowledge in helping our customers succeed with their extrusion projects. By working more closely with our Regional Sales Managers, he will help give ENTEK an unbeatable team that is second to none in the industry."



## **New Literature**

ENTEK has produced two new flyers: one on our Training Services, and the other on our new Health & Wellness Checks for Twin-Screw Extruders. Contact Tammy Straw at (541) 259-1068, or tstraw@entek.com, to receive a print or e-mailed copy!

#### **ENTEK** WHAT WE DO

#### **Did You Know?**

ENTEK offers health and wellness checks! ENTEK offers a variety of health and well Categories include but are not limited to: Critical Mechanical Health Checks General Mechanical Wellness Checks

- ed Electrical Checks ed Maintenance Checks
- A scheduled health or wellness check includes
- t checklist and planning call n-site extruder check-out by a trained te hensive report on the findings
- ct ENTEK to request a qu



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#### *<i>CENTEK* WHAT WE DO

### **Did You Know?**

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# Processing Tips (Pumping Efficiency)

By Dean Elliott, Technical Processing Manager

Although an excellent mixing device, the pumping efficiency of a co-rotating TSE (twin screw extruder) is poor, approximately 15% efficient. This is manifested as undesirable temperature rise of the molten compound occurring mostly at the screw tips (discharge end of the extruder). A restriction here, for example, small diameter die holes and/or a tight mesh screen pack increases the exit melt pressure and results in a temperature rise of the molten compound. This temperature rise can limit extrusion output rates therefore taking steps to minimize this temperature rise can be crucial to the process. A test was set up at the ENTEK Pilot Plant to minimize temperature rise by making some simple processing changes without incurring capital expenditure. This test was performed with a 50% talc filled 12 melt polypropylene masterbatch on a 43mm co-rotating TSE. Here are the learnings:

- 40 pitch convey screw elements (CoC-2-40) performed the best.
- 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 extruder exit barrels (last 2) at significantly lower barrel temperature set points, significantly reduced the compound melt temperature.

The test was carried out by installing 3 different restrictions at the outlet of the extruder to simulate a low, medium and high back pressure of around 500, 900 and 1,300 Psi for this compound. The temperature probe shown below was used to measure temperature rise.



The last 240mm (5.5 L/D) of convey elements on the extruder screw configuration were altered with different styles and pitches. Below is a graph showing the resulting temperature rise with respect to the different pitch convey elements.



Exit Melt Temperature VS. Exit Melt Pressure for Convey Elements (43MM Extruder, 200 RPM, 250 PPH)

Operating the last 2 barrels set at a temperatures roughly 200°F colder than the upstream adjacent barrels was explored further to extrapolate the benefit shown in the graph above for higher rates. Operating at 750 lbs/hr, 600rpm screw speed using 40 pitch convey elements at the discharge end of the screw and a back pressure of 1,260Psi, the melt temperature was 470°F. The last 2 barrel temperatures were lowered and the pressure increased to 1,385Psi and the melt temperature dropped to 456°F. This indicated a benefit but a diminished benefit compared to the lower extrusion rates as shown in the graph above.

This test concluded that a 1 D pitch convey screw element is the most efficient pitch for pumping, in this case 40 pitch for a 43mm diameter extruder. It was also noted that significantly lowering the temperatures of your last barrel or two reduces melt temperature.







## We Are ENTEK

WHO WE ARE WHERE WE ARE WHAT WE DO

# Ad Campaign Update

In the last issue of *Extrusion Solutions*, we showed you the first of our new ad campaign featuring ENTEK President, Dr. Kirk Hanawalt, explaining in his own words, 'Who We Are'.

Since then we have launched the second and third ads in the campaign. ENTEK's Vice President of Sales, Linda Campbell, is featured in our 'Where We Are' ad, and Dean Elliott, ENTEK's Technical Processing Manager, is featured in our latest ad titled 'What We Do', where he describes ENTEK's customer training services.

Watch for more ENTEK ads in 2020 in the leading plastics industry trade publications! We will expand the campaign by featuring additional ENTEK employees talking about key attributes of the company including product range, technical expertise, market reach, and more.

### **CENTEK** WHO WE ARE



### Upcoming Events

See ENTEK at the following upcoming events in 2020

**February 17 - 19 – Plastics Recycling** Gaylord Opryland Resort and Convention Center, Nashville TN

October 13 - 15 - Extrusion 2020 Stephens Convention Center, Rosemont, IL

November 4 - 5 - Compounding World Expo Cleveland, IL







### Who to Contact

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