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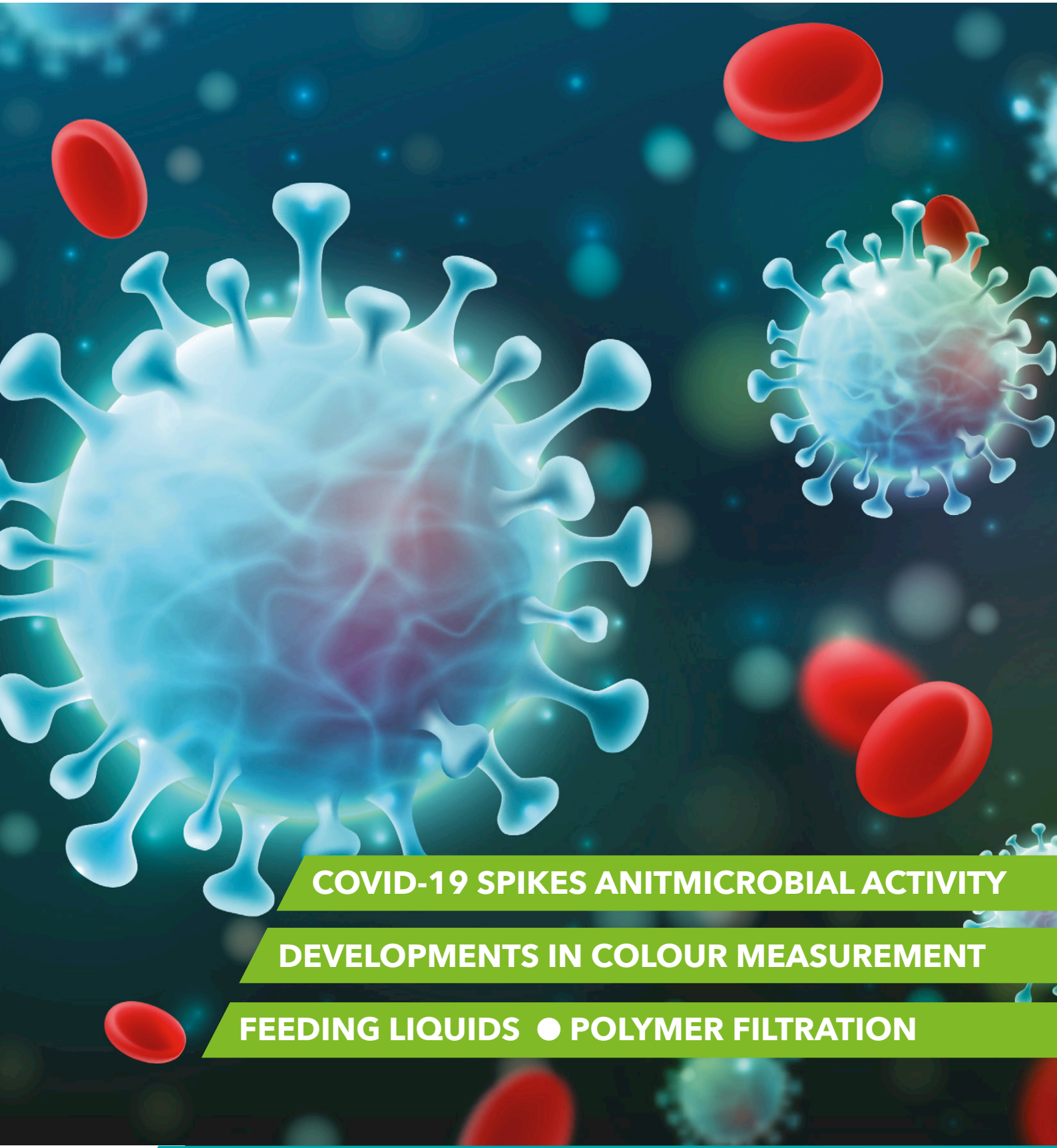

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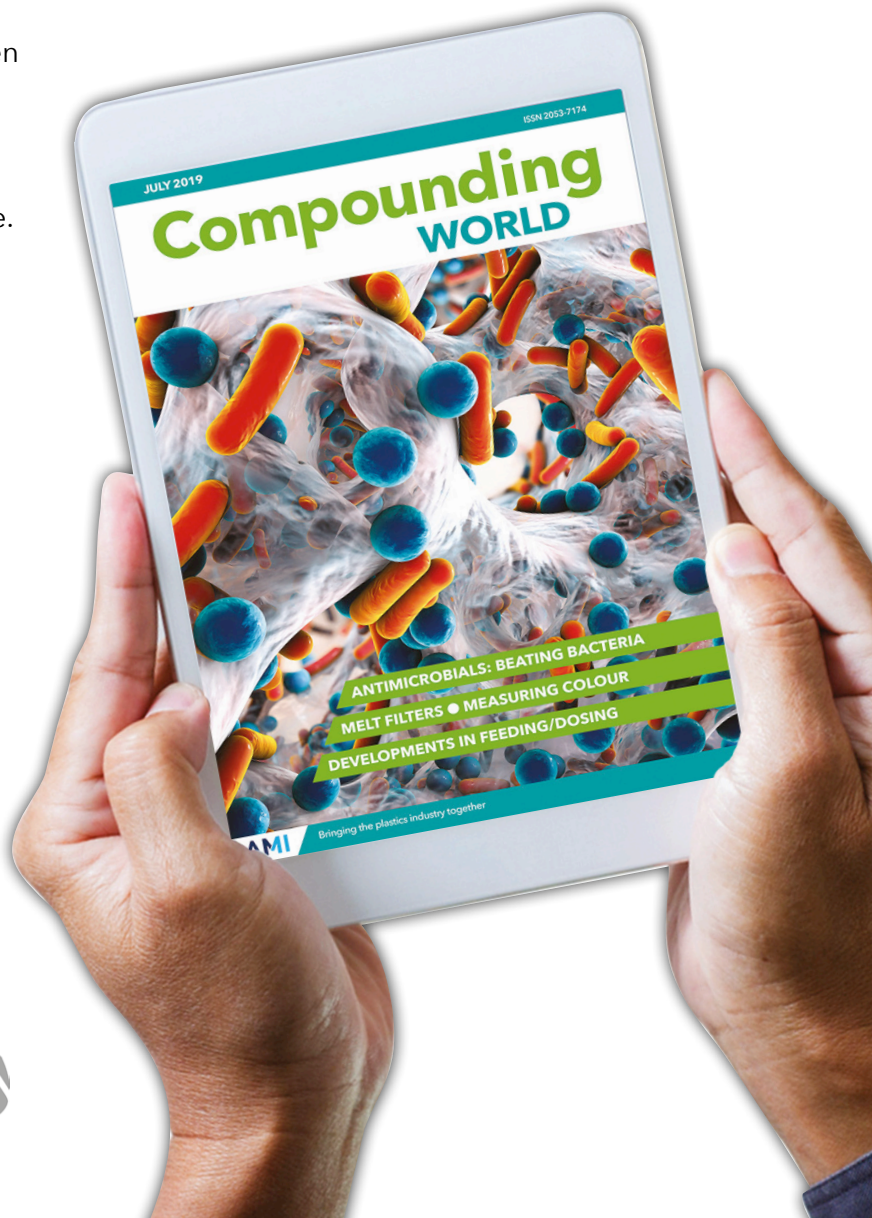

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Third Floor, One Brunswick Square,
Bristol, BS2 8PE, United Kingdom
Tel:+44 (0)117 924 9442
Fax:+44 (0)117 311 1534
www.ami.international
www.twitter.com/plasticsworld
Registered in England No: 2140318

EDITORIAL

Editor-in-Chief: Chris Smith
chris.smith@ami.international

Technology editor: Peter Mapleston
editorial@compoundingworld.com

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

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

ADVERTISING

Advertisement manager: Claire Bishop
claire.bishop@ami.international +44 (0)1732 682948

Sales & commercial manager: Levent Tounjer
levent.tounjer@ami.international +44 (0)117 924 9442

Sales manager (China): Jenny Zhou
jenny.zhou@ami.international +86 13651 985526

Events and magazines director: Andy Beevers
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PolyOne becomes Avient on closing Clariant deal

Global compounder PolyOne changed its name to Avient at the beginning of this month. The rebranding follows the closing of its previously-announced acquisition of the colour masterbatch businesses of Clariant and Clariant Chemicals India.

The acquired businesses become part of the Avient Colour, Additives & Inks segment. They include 46 manufacturing operations and technology centres in 29 countries and some 3,500 employees. The net purchase price amounted to $1.44bn, with the newly combined operations posting sales of $2.9bn and employing 9,100 employees in 2019.

"With this acquisition, Avient now expects over 85% of adjusted EBITDA to be generated from specialty applications," said Robert M Patterson, Chairman, President and CEO of Avient. "This is up from less than 10% when our specialty journey began over a decade ago."

Robert M Patterson, CEO of Avient (formerly PolyOne)

Shortly before the completion of the deal, what was then PolyOne announced expansion of manufacturing of three of its specialty product lines. Its Nymax PIR recycled PA products and ReSound bio-based TPEs, which are currently made only in Europe, will in future also be produced in the US. And OnFlex TPEs, currently made in the US, will be produced in Europe.

Nymex PIR grades contain 20-100% post-industrial materials and are said to offer comparable performance to virgin PA. ReSound bio-based TPEs contain 40-50% bio-renewable content from sugarcane and are said to offer hardness levels and performance comparable to standard TPEs.

OnFlex TPEs are primarily aimed at automotive applications. OnFlex LO grades meet stringent odour and fogging standards for use in HVAC seals and flaps; OnFlex AF grades are said to provide long-term sealing performance, reduced noise and vibration, and very good UV resistance and weatherability.

› **www.avient.com**

Ascend buys in China

Ascend Performance Materials has made its first acquisition in China, buying the assets of NCM (Changshu) and Tehe Engineering Plastic (Suzhou). Both are located on Changshu Yushan High-Tech Industrial Park around 100km from Shanghai.

Terms were not disclosed but Ascend said it plans to take final ownership in August. It said the move will provide it with "a flexible footprint for growth in the region".

The company said it plans to expand the existing compounding assets at the site and create an R&D centre to focus on existing applications in the automotive, electrical and electronics, and consumer and industrial markets, plus new areas like 3D printing and performance films.

› **www.ascendmaterials.com**

Lanxess goes ECO with recycled glass

IMAGE: LANXESS

Glass fibre production at the Lanxess plant at Antwerp

The High Performance Materials business unit of Lanxess has launched three new certificated Durethan ECO PA6 compounds containing glass fibre manufactured from post-industrial glass waste.

The Durethan ECOBKV30H2.0, ECOBKV35H2.0 and ECOBKV60XF grades contain 30%, 35% and 60% glass by weight respectively. Independent inspection company Ecocycle has awarded each an Ecoloop certificate in accordance with ISO 14021:2016, the company said.

All three grades are said to display performance identical to compounds based on glass fibres manufactured from virgin raw materials. The main target market for them is the automotive industry.

Lanxess said it intends to gradually increase the number of mass balance-certified ECO product types. For example, it cites the planned introduction of a new reduced carbon footprint PA6 with 30% glass fibre content based on caprolactam from 'green' raw materials.

› **www.lanxess.com**

Mitsui compounds in Europe

Mitsui Chemicals of Japan and Prime Polymer, its 65-35 joint venture with Idemitsu Kosan, have begun compounding operations at Mitsui Prime Advanced Composites Europe (ACE).

The new facility, which is located at the Chemelot Industrial Park at Geleen in the Netherlands, is Mitsui's first PP compounding site in Europe and has a production capacity of 30,000 tonnes/yr, the company said.

Mitsui Chemicals Group currently operates compounding operations in Japan, US, Mexico, Thailand, China, India and Brazil.

Above: Mitsui Prime ACE is now compounding at Chemelot park in the Netherlands

The company said the new European facility is a step towards its goal of "an integrated European system for research, production and sales". It said it will ultimately enable it to offer light-weighting services to European OEMs and automotive parts manufacturers, while also responding to global demand growth.

Although automotive production volumes are down worldwide due to COVID-19, Mitsui expects the light-weighting trend to continue with longer term demand for PP compounds in bumpers, instrument panels and other parts to grow.

› **www.mitsuichemicals.com**

NEWS IN BRIEF...

Thailand's **Indorama** has acquired AG Resinas, which processes post-consumer PET into flakes and pellets at a 9,000 tonnes/yr facility at Juis de Fora in Brazil. The deal is said to be "strategically in line with the IVL's long-term sustainability objectives and will complement IVL's PET business in Brazil".
www.indoramaventures.com

Grafe Polymer Solutions has started production and sales in Germany for **Röhm**'s small volume coloured Plexiglas moulding compounds. Röhm said customers will benefit "from the combination of product and colour quality, the comprehensive service and the fast development and delivery times at Grafe".
www.roehm.com
www.grafe.com

Steilemann heads PlasticsEurope

PlasticsEurope has named Dr Markus Steilemann, CEO of Covestro, as its new President. He succeeds Javier Constante—President of Dow Latin America—who had lead the association through its recent reorganisation.

"Particularly in these challenging times, the industry needs a visionary and a capable leader," said Constante. "With Markus at the helm, I believe that PlasticsEurope is well set-up to tell the story of the industry's circularity transition."

Steilemann joined Bayer in 1999 and held various positions in the Polycarbonates business unit of Bayer MaterialScience, Covestro's predecessor. In 2015, he became Head of the Polyurethanes business unit, then Chief Commercial Officer in 2017 and CEO in 2018.

› **www.plasticseurope.org**

Covestro CEO DR Markus Steliemann takes over the presidency of PlasticsEurope

NEC commences NeCycle sales

NEC Platforms, a subsidiary of Japan's NEC, has commenced global sales of its cellulosic biodegradable plastic NeCycle, which it has been developing since the early 2000s.

NeCycle is 50%-derived from cellulose from wood and rice straw and is described as a highly functional polymer with durability appropriate for a wide range of products. It is claimed to biodegrade in natural environments—including marine—in approximately four years.

NEC Platforms said it will offer "optimal component shapes, moulding conditions and mould designs for NeCycle, while expanding sales of pellets and moulded components for interior products, automotive products and office automation equipment that emphasise environmental and decorative properties". It aims to achieve annual sales of around $46m by 2025.

› **www.nec.com**

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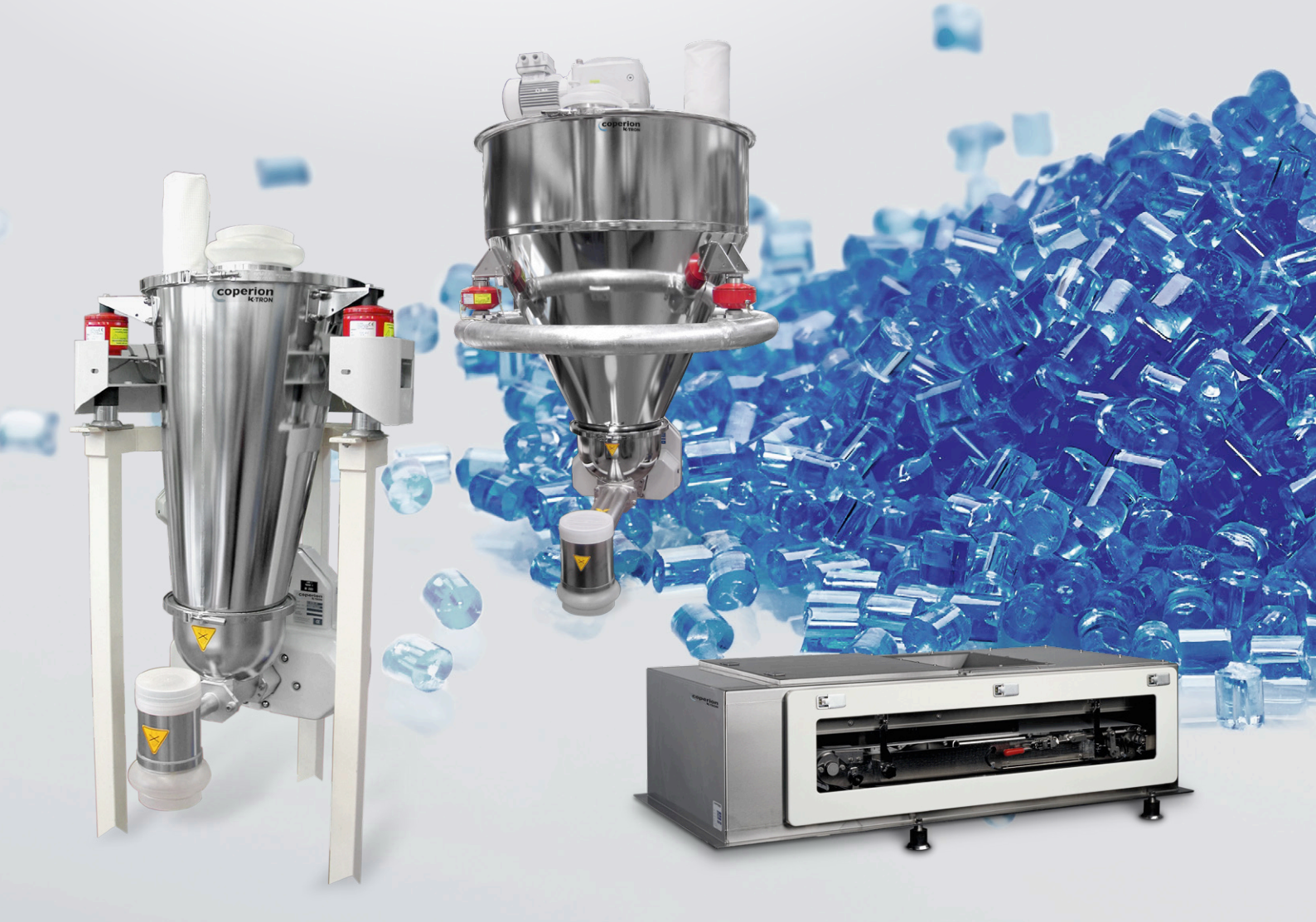

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Chroma Color acquires Epolin

US-based colour and additive concentrates supplier Chroma Color Corp has acquired Epolin Chemicals, a leading player in near-infrared absorbing dyes and specialty thermoplastic compounds. Financial terms were not disclosed.

Epolin is active in applications involving sensors, security inks, light filters, touch-screens, night vision products and eyewear and will continue to operate as an independent subsidiary within Chroma Color, which is owned by private equity firm Arsenal Capital Partners.

Chroma Color CEO Tom Bolger said the deal significantly expands Chroma's offer and will contribute significantly to its goal of "leadership in the colorants and additives industry". It will also offer opportunities for cross-selling where IR absorption is required in combination with traditional colour.

› **www.epolin.com**
› **www.chromacolors.com**

Miele opts for Elix ABS

German domestic appliance producer Miele has selected Elix Polymers' high-flow ABS grade 118HF for its latest rechargeable battery-powered vacuum cleaner, the Triflex HX1.

Elix, which is based at Tarragona in Spain, said it developed the 118HF grade specifically for the Miele application, which required high flow, dimensional stability, good heat resistance and high surface gloss.

The material is supplied pre-coloured by Elix Polymers in custom grey, red and white.

› **www.elix-polymers.com**

Bio-Fed pitches bio-compound

Akro-Plastic subsidiary Bio-Fed has introduced a new renewable compound for injection moulding applications– M·VERA GP1012. The material boasts a near 100% renewable raw material content and carries both the 'OK biodegradable SOIL' and' OK compost HOME' certifications from by TÜV in Austria and Belgium at wall thicknesses of up to 1mm. Food safety approval has also been granted.


IMAGE: BIO-FED

The company, based in Cologne in Germany, said the new grade is particularly suitable for rigid applications requiring a tensile modulus of up to 2,000MPa, such as household articles and coffee capsules.

› **www.bio-fed.com**

Dow to offer PCR resin family

Dow has announced it is developing a new family of recycled resins produced from post-consumer collected flexible and rigid plastic packaging.

The company said some of the PCR recycled products are already available in Europe and Asia. They will ultimately be sold worldwide. It said performance is comparable to virgin resins but the carbon and energy footprints are reduced by 20-30%, depending on the application.

Current grades are targeted at applications including collation shrink film for secondary packaging and rigid packaging for home care products.

› **www.dow.com**

Teijin ups carbon fibre capacity in Europe


IMAGE: TEIJIN

Teijin will up capacity for its Tenax chopped carbon fibre in Europe

Teijin Carbon Europe, the Germany-based subsidiary of Japan's Teijin Group, has increased capacity for its Tenax-E HT C604 6mm grade of chopped carbon fibre by 40%. The investment is said to be a response to growing demand for the material from European electronics manufacturers and medical device producers.

According to Teijin, the C604 carbon fibre grade is is used in high-grade polymer compounds, where it provides good mechanical properties and electrical conductivity. It has previously been supplied to the European market from the company's Mishima plant in Japan.

The company said other grades of Tenax short carbon fibre, will continue to be produced at its facilities in Japan and the US.

› **www.teijin.com**

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Covestro and Teknor Apex deal

Covestro and Teknor Apex have signed a cooperation agreement on compounding thermoplastic polyurethane (TPU) under the Desmoflex brand.

"We are happy to team-up with such a competent and complementary partner for processing TPU on a global scale. Together with Teknor Apex, we want to develop customised products to grow together with our existing and new customers," said Dr Thorsten Dreier, the new Global Head of the TPU business at Covestro.

"The combination of Covestro's expertise in TPU resin with Teknor Apex's custom formulation and compounding capabilities provide a compelling value driver for our combined customers worldwide," said Sachin Sakhalkar, Vice President, TPE Division, at Teknor Apex.

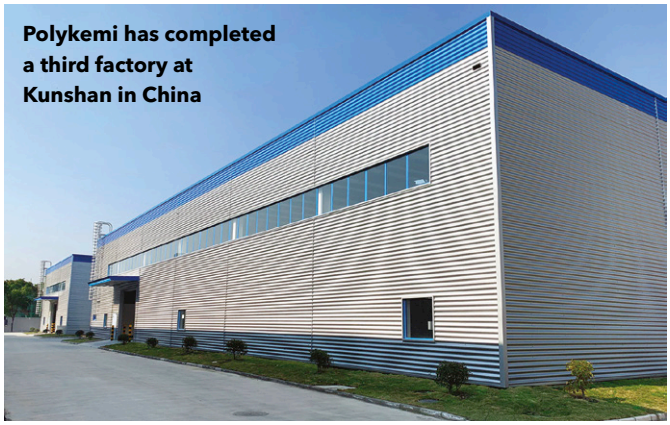
› **www.covestro.com**
› **www.teknorapex.com**

Polykemi opens its third production unit in China

Swedish compounder Polykemi has completed construction of a third factory at its site at Kunshan in China.

The expansion will ensure the company can meet the increased demand it has seen in China over the past four years, according toMagnus Lindahl, CEO of Polykemi Compounds in Kunshan. The company reports annual growth for the Chinese operation of more than 15%.

The new building has space for five lines and will lift the company's capacity in China from 15,000 tonnes/yr to more than 25,000 tonnes when filled. The first line is likely to be installed in 2021, Polykemi said.



Polykemi has completed a third factory at Kunshan in China

Polykemi Group, which includes Polykemi, Rondo Plast and Scanfill in Sweden and a Polykemi operation in the US as well as the Kunshan operation, recorded sales of €140m in 2019. Production volumes have grown by 5,000 tonnes annually over the past four years to reach around 65,000 tonnes, according to the company.

› **www.polykemi.se**

Mytex to add LFT capacity in US

Mytex Polymers US Corp is to invest $7m at its plant in Newton County, Georgia, US, to produce long fibre reinforced PP compounds.

The company, a subsidiary of Mitsubishi Chemical Corp, will install a new production line at its 13,000m² facility to meet growing demand for LFT PP products, according to an announcement from the Georgia Department of Economic Development and Office of Governor Brian P Kemp.

Mytex Polymers gained its LFT expertise through its 2018 merger with MCC company Comusa, developer of the Funcster LFT products.

› **www.mytexpolymers.com**

Lati PA6 takes the heat in LED lighting

Whitecroft's Mirage 3 luminaires use thermally conductive PA6 heat sinks

IMAGE: WHITECROFT LIGHTING

UK lighting manufacturer Whitecroft Lighting has adopted a thermally conductive PA compound from Italian specialty compounder Lati to produce its new Mirage 3 range of luminaires.

The Laticonther 62 GR/50 grade is a PA6 filled with graphite flakes that offers a thermal conductivity of more than 10W/mK. It is used to produce the heat sinks for three different luminaires in the Mirage 3 range.

Lati worked closely with UK moulder Protool Plastics Group to develop the parts. The Italian company said the combination of its materials and simulation know-how with Protool's expertise in polymer heat sink production was "pivotal" in ensuring the parts were fit for the manufacture.

› **www.lati.com**
› **www.protoolplast.com**

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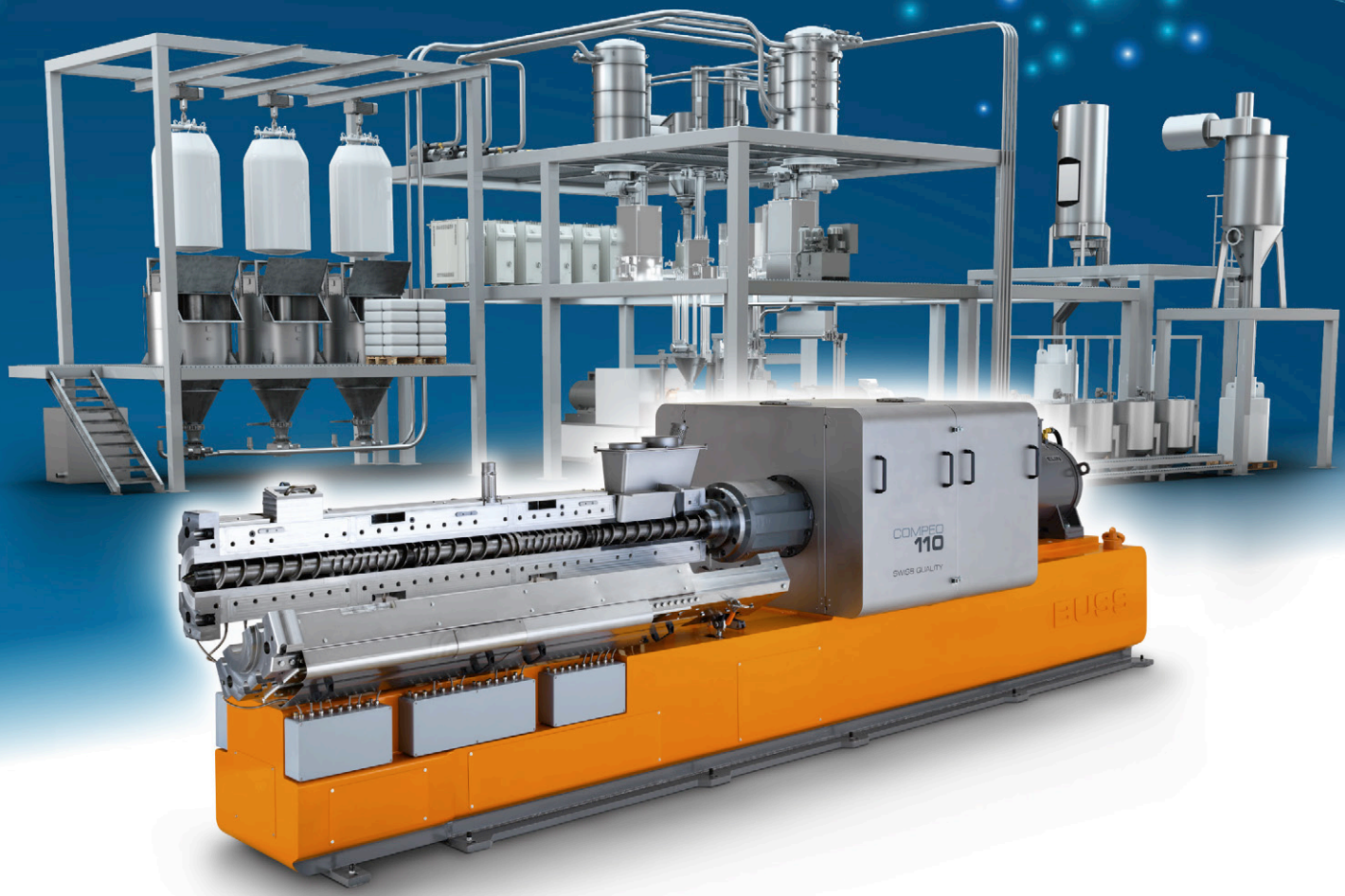

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Q1 sales down 52% at ChinaXD Plastics

NASDAQ-listed China XD Plastics reported a 52% year-on-year decline in revenues to $145m for the first quarter of 2020 as the impact of the Covid-19 pandemic hit it core automotive industry market. Profits were down by 90% to $5.2m.

"China's auto industry was hit hard with production and sales decreased by 45.2% and 42.4% respectively for the first quarter of 2020," said Chairman and CEO Jie Han. He said the company's manufacturing facilities at Harbin and Sichuan in China were temporarily shut down in February and March 2020. Operations at its Dubai plant have been suspended since early February 2020 in line with local government directives.

Han said the company had placed more focus on high-priced semi-finished goods in its domestic market during Q1, achieving a 65.6% increase in average RMB selling prices and partially offsetting the 70% sales volume decline.

He said the company was continuing with plans to upgrade existing equipment, which will see capacity at its Heilongjiang Campus at 390,000 tonnes by the end of the year. It will aos install 10 lines at its Sichuan base to take capacity to 300,000 tonnes.

Earlier last month, China XD announced plans to delist from NASDAQ. An offer of $1.20 per share has been proposed, valuing the business at around $41m.

› **www.chinaxd.net**

Ineos buys BP's aromatics

Ineos is to buy the global Aromatics and Acetyls businesses of BP. The acquisition is being made via Ineos's Styrolution subsidiary and the price to be paid is $5bn, of which $4bn will be payable upon completion and the remainder deferred until no later than June 2021.

The purchase will extend both the portfolio and the geographic reach of Ineos, which is already one of the world's leading petrochemical companies. Jim Ratcliffe, Ineos Founder and Chairman, described the move as "a logical development" of its existing business that will expand its footprint at Geel in Belgium and reintegrate its site at Hull in the UK.

The two BP businesses include 15 sites–five in the Americas, two in Europe and eight in Asia–plus ten joint ventures.

› **www.ineos.com**

NEWS IN BRIEF...

Invista held a ground-breaking for its 400,000-tonnes/yr adiponitrile (ADN) plant on the Shanghai Chemical Industry Park in China last month. The facility, which is due to open in 2022, will supply ADN for production of PA66. It will be integrated with the company's hexamethyldiamine and polymer facilities to supply domestic customers directly.
www.invista.com

US performance plastics supplier **Conventus Polymers** has opened a series of warehouses in China. Located in Shanghai, Suzhou, Shenzhen, and Hong Kong, it is working with three primary local compounding partners that each specialise in different areas to offer a full portfolio of compounds on quick turnaround with minimal freight costs.
www.conventuspolymers.com

Teknor Apex adds to capstock options

Weatherguard is claimed to overcome 'water whitening'

IMAGE: TEKNOR APEX

Teknor Apex has added a series of acrylic-based compounds for use as highly weatherable, dark-coloured outer or 'cap' layers in PVC exterior products. The compounds will be marketed under the Weatherguard name.

The company said Weatherguard WG-8000 series compounds offer better weathering performance than current acrylic capstocks with similar physical properties. After 10,000 hours in QUV accelerated weathering tests, Weatherguard WG-8000 is said to display a colour change of less than 1 Delta E for black. This is said to be due to improved resistance to the common 'water whitening' weathering problem.

Impact performance is said to be similar or better to current grades.

› **www.teknorapex.com**

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NEWS IN BRIEF...

Nordmann is to distribute the full range of organic coloured pigments manufactured by India's **Sudarshan** in the DACH and Nordic regions plus parts of South-East Europe. The new pigments will extend Nordmann's current portfolio, which is focued on metallic and effect products.
www.nordmann.global
www.sudarshan.com

Borealis has decided not to pursue development of an integrated cracker and PE project in Kazakhstan. The decision, the company said, "is based on a thorough assessment of all aspects of the prospective venture and impacted by the effects of the Covid-19 pandemic as well as the increased uncertainty of future market assumptions".
www.borealisgroup.com

KraussMaffei upgrades 'upcycling' demo plant

KraussMaffei has upgraded the demonstration 'Edelweiss' recycling compounding line at its R&D centre at Hanover in Germany to include its recently introduced cutter-compactor and dual twin screw extruder configuration.

The use of two twin screw extruders rather than the more usual single and twin screw combination provides higher degassing capacity, more efficient odour removal, better dispersion and mixing, and more gentle processing without sacrificing throughput, according to the company. The installation uses two ZE65 BluePower machines and has a maximum output of 2,000 kg/hr.

The new cutter-compactor can handle light film scrap with moisture contents of up to 10%. It demunidifies, compacts and homogenises the waste feedstock prior to discharge on to a belt weigher that feeds the first extruder. "This enables gravimetric feeding with an accuracy of 99.8%," said Carl-Philip Poepel, Director of Product Management Extrusion Technology at the company.

IMAGE: KRAUSSMAFFEI

Above: KraussMaffei's upgraded 'upcycling' trial line at Hanover

Designed for 'upcycling' of waste to new compounds, the upgraded line is available for industrial scale development trials and is supported by the company's analytical laboratory and sampling injection moulding machine.
› **www.kraussmaffei.com**

Chemical recycling industry association hits out at 'waste priorities' restrictions

Trade association Chemical Recycling Europe (CRE) has responded to the '**10 Priorities to Transform EU Waste Policy**' document developed by ZeroWasteEurope and a number of EU-based NGOs and associations.

While broadly supporting the "ambitious directions" the document envisages for waste policy and the hierarchy of waste, CRE is opposed to some restrictions including those in its Priority 9. These, it said, "represent missed opportunities to improve the current waste and recycling system, leading to some inconsistencies between priorities".

CRE set out some clarifications. First, it said, chemical recycling "is circular by definition" as it facilitates direct replacement of virgin material with material of identical quality and properties, converting plastic waste to different value-added materials.

The association also argues that neither input characteristics nor input origin should be restricted for materials used in chemical recycling. Because the materials generally have little value and tend to be contaminated, it said this does not mean that chemical recycling should be applied only to these. It said many complex plastics are not economically viable streams for mechanical recycling and such restrictions would stop chemical recycling capturing the them.

CRE also said that the document's Priority 9 restrictions conflict with its Priority 10, which is to phase out energy from waste, because it would divert more waste that way. Finally, it argues that chemical recycling specifically targets demand for virgin-quality recycled content that mechanical recycling can at present fulfil only for PET and HDPE under strict conditions.
› **www.chemicalrecyclingeurope.eu**
› **www.zerowasteeurope.eu**

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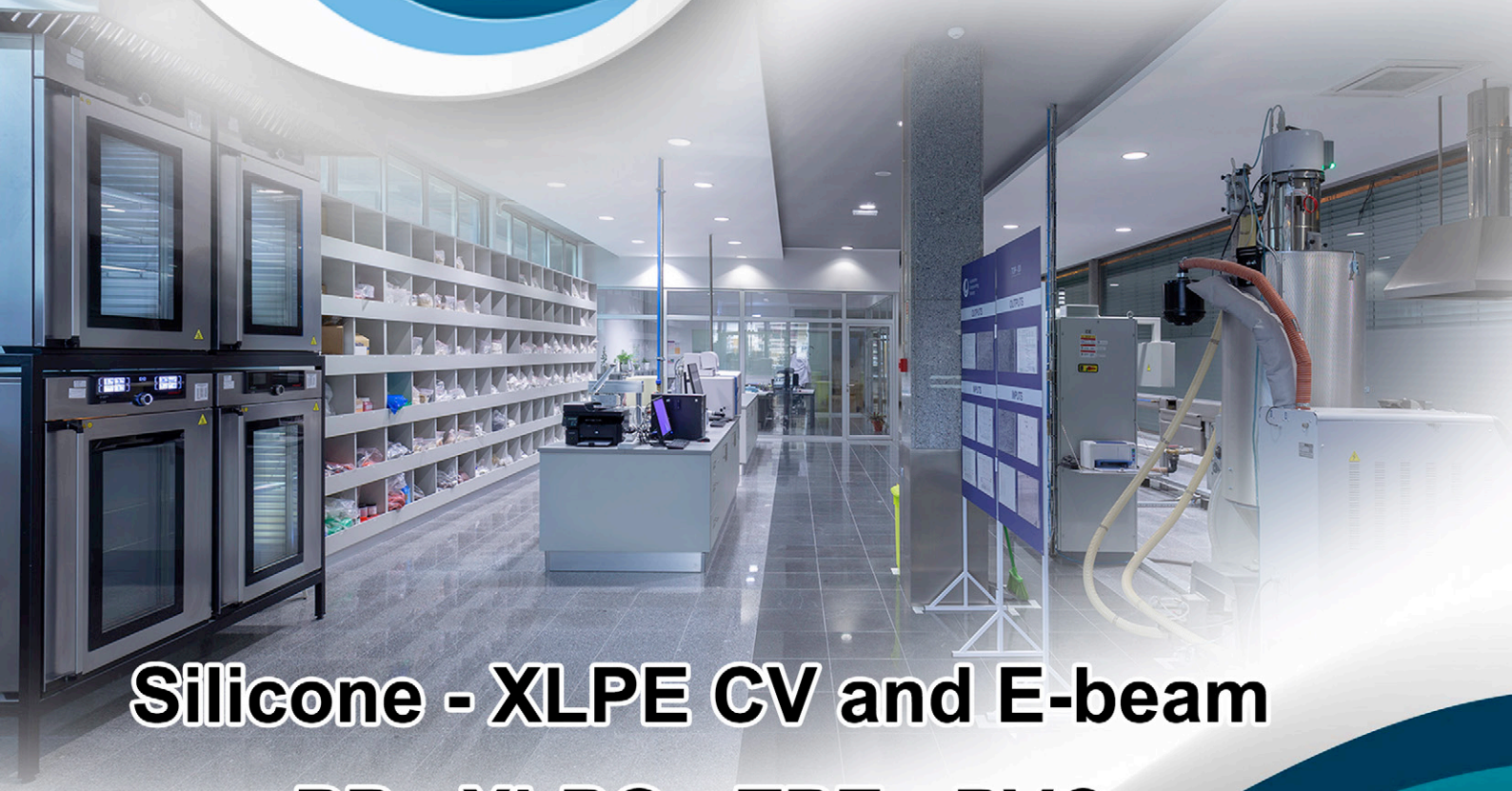

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Consistency in colour

Colour is a challenging attribute to define and communicate but the latest measurement instruments and software may offer solutions, learns Jennifer Markarian

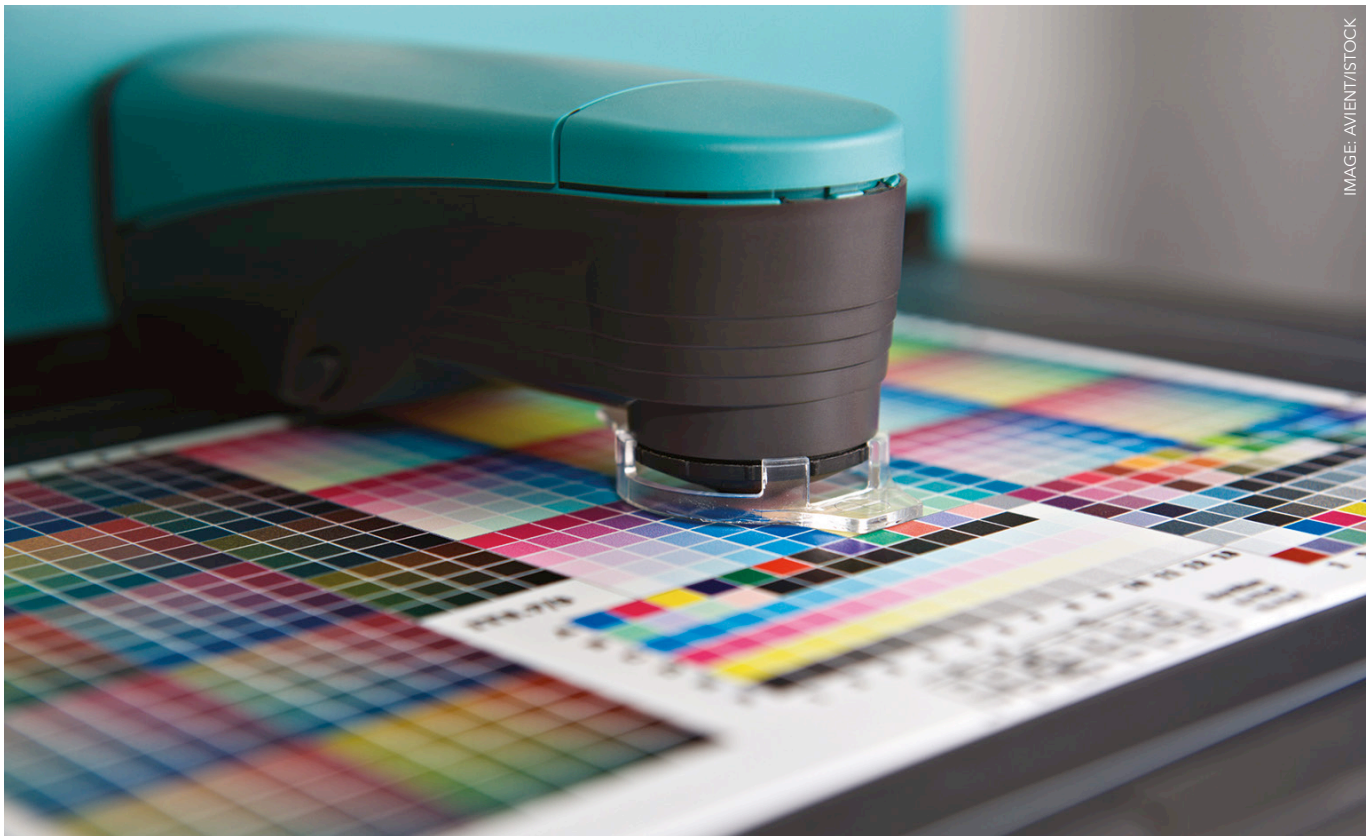

IMAGE: AVIENT/ISTOCK

Main image: Measuring and communicating colour can be a major challenge for plastics users and processors, especially for those active over multiple locations

Whether for aesthetics, branding or safety, colour is a critical attribute for many plastics products. And, with many products today assembled from parts produced across different locations, ensuring consistency can be an absolute essential for plastics processors and suppliers of colour masterbatch (concentrates) and compounds. Spectrophotometers are widely used across the plastics industry to enable accurate and repeatable instrumented colour measurement. These instruments are now supported by an expanding selection of colour matching, formulation, quality control, and data management systems designed to ensure global consistency throughout the process of delivering a coloured plastic part.

"Colour consistency is often associated with high quality products, making it an important consideration," says Earl Balthazar, Senior Applications Engineer at **Datacolor**. "Additionally, colour problems can create unnecessary production expenses and delays, making it important to properly manage colour throughout production."

Although spectrophotometers are capable of measuring accurately and consistently, in real world use there are many factors that can affect measurement consistency and must be accounted for, including sample temperature, gloss, opacity, and sample thickness. Thermochromism—colour change due to temperature—affects nearly all pigments and dyes, says Balthazar. "Sample conditioning is a key element for measurement repeatability as variations in temperature can contribute to changes in measurement data, and not all materials and colours respond in the same way to these variations," he says.

While temperature affects an actual colour measurement, gloss affects the appearance of colour, Balthazar explains. Even if two objects have

Right: The SpectraVision V is able to measure colour of plastic pellets and granules, eliminating the need to mould plaques

the same colour measurement, a glossy object can appear to be a different colour from a matt one, he says. The difference in surface gloss can be accounted for by measuring a sample using modes that include and exclude specular light and by using gloss compensation software to apply calibration and mathematical models. "[Software] can determine a relative gloss and adjust the measurement as if both samples were the same gloss. It can also adjust formulas for desired gloss outcomes to further improve matching capabilities," he says.

The influence of temperature and other material characteristics on colour is also highlighted by Felix Schmollgruber, EMEA Technical Applications Manager at **X-Rite**. "Controlling sample temperature is widely underestimated in the context of colour consistency," he says. To this end, the company's X-Rite MA-5 QC multi-angle spectrophotometer includes an on-screen temperature preview to help identify how the temperature of the sample might affect colour data.

Schmollgruber also highlights variation in material opacity as another significant factor in appearance and in consistent colour measurement. "To match colour on translucent or transparent materials you need both reflection and transmission measurements," he says. The thickness of a plastic sample is also important, he explains, since while it may appear visually opaque, if a light source is placed behind it light may pass through. He says that best practice is to have a specific backing material for a colour measurement device and to define standard operating procedures for consistency.

"X-Rite's Colour iQC software provides that traceability by documenting every single measurement–what the specific measurement conditions were and how the sample was placed onto the instrument's aperture," he says.

In addition to gloss level and part thickness, factors such as polymer type, surface texture, and part geometry can also affect the quality of the measurement, says Sam Koukios, Product Manager at **Avient (formerly PolyOne)**. "[Measurement quality] is especially critical for transparent or translucent samples, or for special effect colours, which are notoriously more difficult to measure or match digitally," he says. Instruments can be

Colour in three dimensions

The Spectro2profiler is the latest addition to the BYK-Gardner product line, making it possible to measure colour and gloss as well as the 3D topography of the surface. According to the company, the human eye uses all three parameters when it assesses colour, but while colour and gloss is measurable in today's instrumented systems, surface structure can typically only be assessed either visually or using sophisticated microscopy.

The 3D-structure analysis capability of the Spectro2profiler is "brand new", according to Dr Christian Groh, Project Manager at the company. "The Spectro2profiler takes multiple images under different illumination directions to estimate surface curvature. As a result, you get objective measures for cell size (mm²) and perceived cell amplitude (P-µm). Different grain types can be easily differentiated – ideal for design and new supplier approval."

Right: BYK's Spectro2profiler measures colour, gloss and 3D topography of surfaces

The device also provides a 2D camera-based reflectivity measurement for structured surfaces such as simulated leather grain, where the perceived depth is dependent on reflection behaviour of the "hills and valleys". The 2D reflectivity measurement is aligned with the 3D image data to separate the reflection of hills and valleys resulting in a new measurement parameter–reflectivity contrast Rc–that can be used as a QC tool.

The Spectro2profiler is said to be a flexible instrument for measurement of a wide variety of plastic or painted surfaces, ranging from leather-like to fine-textured and smooth. It features an icon-based colour touchscreen control while an integrated camera shows a live preview of the measurement spot to prevent false readings on imperfections or scratches.

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IMAGE: KONICA-MINOLTA

Right: A new Configuration Tool simplifies setting of multiple Konica-Minolta portable spectrophotomers, such as this CM-26d

adjusted to overcome some of these challenges, he says. "For example, a multi-angle spectrophotometer can adjust for light scattering to minimise the effect pearlescents may have on measurements."

These factors are important to consider for both formulation matching and for manufacturing control, as masterbatch and compound producers seek to accurately communicate colour. The latest measurement tools and software improvements aim to make the task easier.

Pellet assessment

The new **Datacolor** SpectraVision V allows smaller samples—including pellets and granules—to be measured. Sample holders on the spectrophotometer are designed to hold very small objects in place in both the vertical and the horizontal configuration, and the instrument also improves accuracy of small samples compared to a traditional setup, says Balthazar. The instrument can also measure three-dimensional objects (measuring colour on the top and multiple sides of an object at the same time offers better quality control, he says).

The instrument can now also measure an individual pellet or measure several pellets and average them together, avoiding the need to mould a plaque. Balthazar says that measurement of opaque pellets is repeatable and there is good correlation between opaque pellets and plaques. He notes, however, that correlation is not yet as defined for more translucent and transparent products, and that more work needs to be done for these.

Below: X-Rite's latest ColoriMatch software release helps users set up global colour ecosystems

The SpectraVision's hyperspectral imaging solution eases colour assessment for textured materials, according to Balthazar. "A traditional spectrophotometer would average the sample measurement space, which includes shaded areas, which results in errors in the lightness of the samples. With the hyperspectral imaging solution, a user can now separate different colours and exclude the shadow (peaks and valleys). With this capability, producers can ensure greater colour matching and consistency from batch to batch."

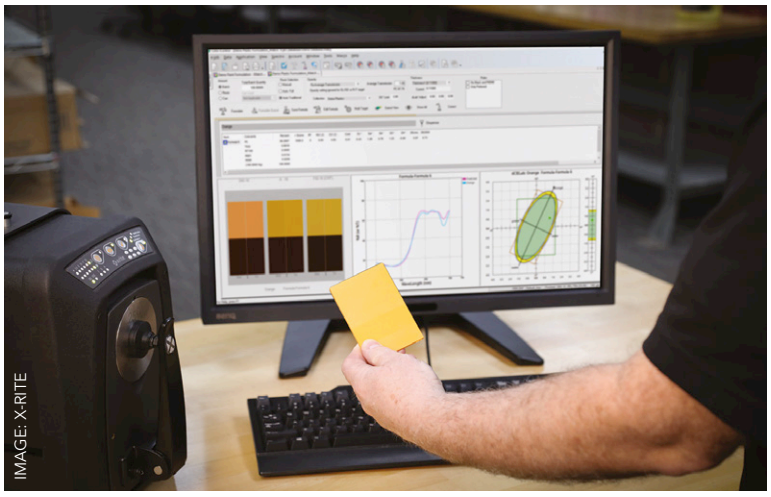

IMAGE: X-RITE

Datacolor also recently enhanced its Tools SV software to incorporate customer feedback. For example, the original sample image can now be captured as a .tiff file to export to third-party programs or to an image library. Another added function is the ability to select multiple areas of the image for colour separation, to enable selection of areas with colours that are too close to be excluded. And a contiguous selection option allows the user to select multiple areas of the same colour in the colour measurement window within a single measurement. This can be used to capture multiple areas of the sample for comparison or average those areas selected, explains Balthazar.

Simple configuration

The latest portable spectrophotometers from **Konica Minolta**– the CM-25d, CM26-d, and CM-26dG –now benefit from a new Configuration Tool. The software is designed to configure the settings on these stand-alone instruments and allows the user to save a configuration file that can be shared across multiple locations. That means that users can ensure all instruments are using the same configuration when collecting measurement data, says Peter Roos, Marketing Manager at the company.

"There is a constant striving toward keeping tighter tolerances between locations," says Roos. He explains that best practices for ensuring this consistency include verifying that configuration settings match, cleaning, servicing, and calibrating instruments at regular intervals, and ensuring that users have good handling procedures for repeatable sample presentation and careful handling of the instrument while measuring a sample.

Released this year, the latest version of **X-Rite**'s

ColVisTec measures colour inline

ColVisTec's inline colour measurement technology was demonstrated at K2019 as part of KraussMaffei's Liquid Colour Compounding process, which metered liquid colours directly into the twin-screw extruder for masterbatch production.

The ColVisTec inline colour measuring system monitored the melt stream directly, eliminating the need for sampling and providing real-time results. It comprised a UV-VIS spectrophotometer with fibre optic probes inserted in the extruder to detect optical changes that take place in the polymer melt. Variations in the spectra reveal dosage fluctuations, segregation of premixes, drift, and colour/recipe changes.

"Operators and process engineers have the possibility to monitor the extruder output in real time and intervene in the process if necessary," says Fuat Eker, Director of Sales, Marketing and Customisation at ColVisTec.

IMAGE: KRAUSSMAFFEI

ColVisTec's inline colour measurement is integrated in KM's liquid colour compounding line

Compounding World's November issue will discuss in-line measurement in more detail.

› **www.colvistec.de**

› **www.kraussmaffei.com**

ColoriMatch formulation and ColoriQC quality control software are said to include a number of enhancements and improvements. ColoriMatch 10, for example, uses a new math engine to improve initial matching and provide quicker correction. "With the new engine we're able to match more than 80% of colour targets within a colour difference of DE2000 <1.0 and correct more than 95% of colours within only one correction step to a DE2000 <0.5," says Schmollgruber.

X-Rite says it is also seeing some demand for a "global quality control ecosystem" for colour and reports that it is working with some customers to connect all their worldwide sites to one central server system using the ColoriMatch online platform. "The connecting piece between masterbatch [producers] and any converters (moulders, extruders) is our NetProfiler technology, which ensures measurement agreement across instrument fleets of even different makes and models," says Schmollgruber.

Digital evaluation

With the use of instruments that can accurately and consistently measure colour, it becomes possible to conduct the process of evaluating, matching, and communicating colour digitally on a computer screen without the need for physical samples. Retailers and brand owners are increasingly using digital data for storage and communication of a wide variety of standards, says **Avient**'s Koukios, but digital colour management is not yet widely used for colour matching or quality control testing in the plastics industry.

Koukios says there are a number of reasons for this. Firstly, he says plastics industry colour personnel have traditionally worked with physical samples, so going completely over to digital is a big change. Consistency in the display screen can also be a challenge, and not all colour designs are easily matched using a spectrophotometer. "Specifically, transparent colours or colours that contain special effect pigments may not be able to be matched," he says.

Management of colour between different production facilities, however, presents an opportunity to use and exploit digital colour management provided that the participating sites are set up with measuring equipment with good consistency between them.

The recent manufacturing and distribution challenges of the COVID-19 pandemic demonstrated the benefit of digital technology. "We witnessed customers relying upon digital colour management to transfer their digital colour standards to other production plants in order to manage ongoing production when certain plants were shut down as a result of the virus, thus allowing other plants to pick up and continue

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Right: X-Rite's Virtual Light-Booth is one of a series of software tools designed to support digital colour evaluation

production without delay," says Balthazar at **Datacolor**. "This was made possible because these companies were armed with high-end spectrophotometers and colour management software, and they had good colour management practices and processes in place."

IMAGE: X-RITE

Virtual solutions

Schmollgruber says that **X-Rite**'s digital tools, including Total Appearance Capture (TAC) technology, "will help designers and material specifiers bridge the gap between design intentions and real-world manufacturing feasibility." He claims the company's appearance exchange format (AxF) "is the first file format exclusively designed for system-independent storage of measured digital appearance. AxF files provide a digital twin of physical materials. AxF is now utilised in a variety of VR [virtual reality] rendering engines and goes far beyond the traditional spectral colour measurement."

Visual assessment of a coloured part is important, particularly for evaluating the impact of surface or texture, but for accuracy should be performed under controlled lighting (such as in a light booth), says Schmollgruber. He adds that X-Rite's Virtual Light Booth (VLB) can be used with TAC and AxF to digitally evaluate colour, texture and finishes under different lighting.

Schmollgruber sees a clear trend developing for elimination of physical samples and to implement integrated digital colour management workflows more widely. But he adds a qualifier. "The specific need in plastic is to not only capture spectral colour but more the full material appearance consisting of colour, gloss, transparency, opacity, surface structure, sub-surface effects, etc."

He reports an ongoing trend for special effect finishes and textures in plastics, which must be measured and managed differently than traditional absorbing colourants. "Colour management instruments need to go beyond simply measuring colour to the inclusion of appearance characteristics such as coarseness and texture," says Schmollgruber. He adds that X-Rite's MA-T instruments with multi-angle spectral measurement, for example, help to quantify colour, sparkle and coarseness.

Alternative approach

One of the drivers for on-screen colour communication and digital colour management is speed. At **Avient**, Koukios says that is a primary reason the company developed its PinPoint colour management system, which offers the ability for injection moulders to match a colour and produce it in minutes. It combines proprietary software and liquid colorant technology from Avient's ColourMatrix Select system together with proprietary, patented dispensing and dosing technology from 3M. The "lean" system reduces the time needed for trans-

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IMAGE: POLYONE

Above: The PinPoint system from Avient (formerly PolyOne) allows plastics processors to colour match small batches on-site

porting samples in multiple iterations with the colour formulator. A spectrophotometer that guarantees consistent measurement is a key to this system.

"Users can confidently share information between locations, generating recipes at one site and producing parts at another, by electronically sharing the formulation and related colour data," says Koukios. "They can even perform quality control without seeing a physical part if required. We also use a number of pre-measured standards to give users the ability to create a formulation without having a physical standard."

A further benefit of the system is that injection moulders only make the amount of product they need, when they need it. "PinPoint has enabled users to produce as little as one pound [around 450g] of colorant for short runs and samples. If the programme grows to larger volumes, we seamlessly transition that product to one of our traditional manufacturing and delivery systems," says Koukios.

Avient also claims PinPoint is useful for colouring post-consumer recyclate (PCR). "We are getting more and more requests for matches including PCR. Processers are required to meet demanding colour specifications and tolerances with very wide colour specifications on their incoming [PCR] raw material colour. PinPoint enables processors to measure their product and correct their colour right on site to compensate for this variability," Kousios says. "The colour correction system that we use is very strong. The system provides a convenient way to store the desired colour target and adjustment history in the cloud to ensure that all users are seeing the same data for that product."

Tackling variation

Plastics certainly pose a complex challenge to colour matching and control because the colour must appear correctly in the end-use part, despite considerable variability in materials and processing. Variability in the polymers used is a significant challenge, according to Koukios. "There are hundreds of different PP or HDPE resins [for example] with different levels of clarity and yellowness indices impacting the final colour of the part. In other words, we can't take the exact same colour and put it in two different resins and expect to achieve the same result. This becomes even more complicated as customers may blend different resins or buy resin blends to get desired physical properties," he explains.

The aim is to have the correct colour at the point of use, so the entire lifecycle of the coloured part must be considered, such as the potential for colour fading in outdoor use, says **Datacolor**'s Balthazar. "For manufacturers, it's not just a target you're trying to hit from an aesthetic perspective. They also need to consider the end use and build both colour and additive formulation to deliver the expected quality outcomes for the length of life of the product as well," he says.

CLICK ON THE LINKS FOR MORE INFORMATION:

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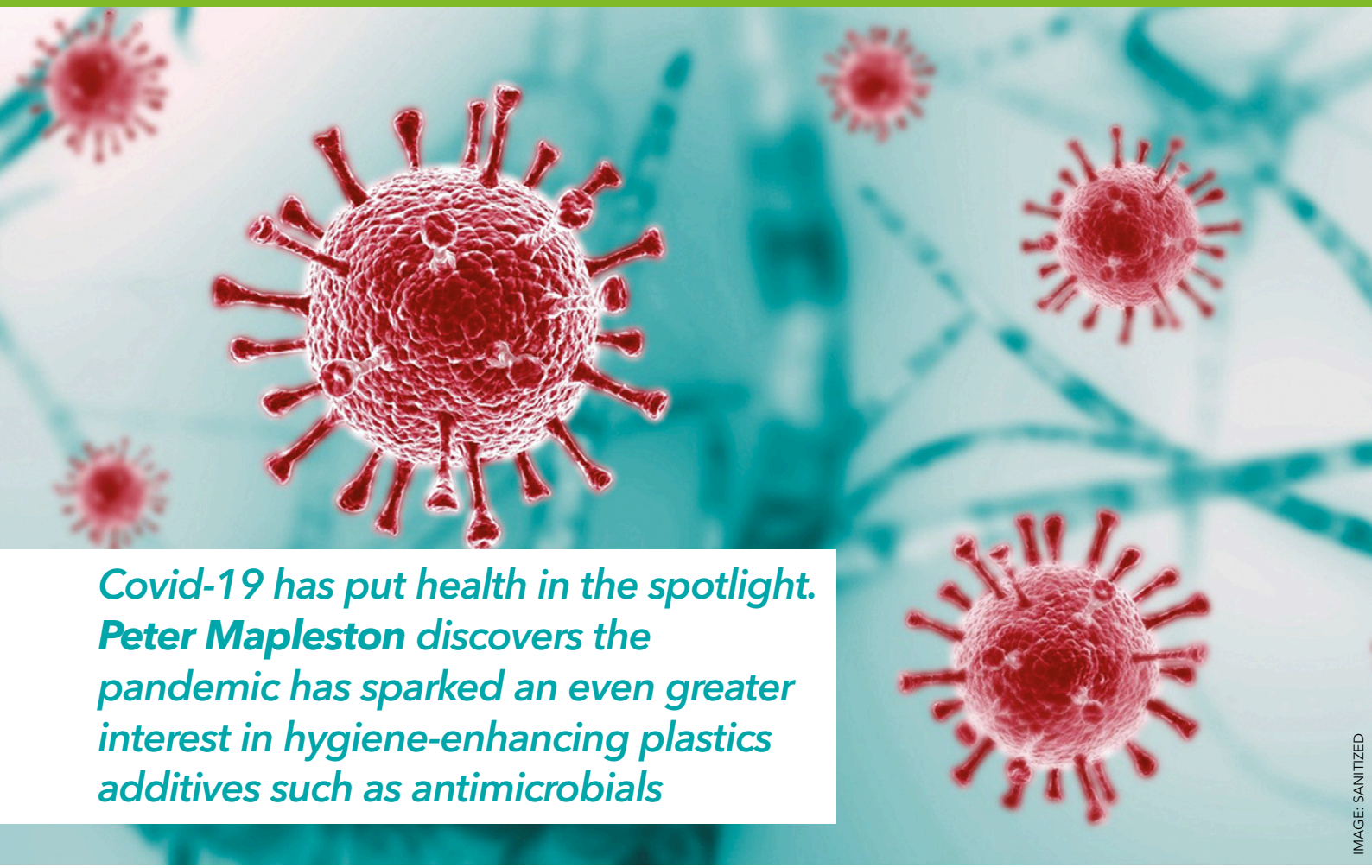

*Covid-19 has put health in the spotlight. **Peter Mapleston** discovers the pandemic has sparked an even greater interest in hygiene-enhancing plastics additives such as antimicrobials*

IMAGE: SANITIZED

Antimicrobial sector sees Covid-19 spike

The Covid-19 pandemic has brought the need to keep things clean into sharp focus. As a consequence, recent months have seen a renewed interest in additive technologies that help preserve the properties, and the hygiene performance, of plastics products used in all sorts of applications. This article is focused on biocides and antimicrobials that tackle bacteria on plastic surfaces. Covid-19 is a virus, not a bacteria, but its spread has led to numerous discussions over if, and how, antimicrobials may be able to help keep it at bay.

Aside from today's Covid-19 concerns, there is a lot of development work going on to make antimicrobials better at fighting bacteria. This is especially challenging in a world where regulations on their use are increasing in severity—one person's life saver can be another's health hazard.

Antimicrobial technologies are employed to protect polymer materials from mould, mildew, fungi, algae, and other organisms capable of damaging their integrity. They can be added to a variety of plastics to offer protection against microbial attack of the final article, helping to retain its original performance and aesthetics and extending its lifetime.

Where optimum conditions for growth exist, fungi, algae and bacteria may colonise and degrade the plastic by utilising material within the bulk, or on the surface, of the article. This growth can result in surface staining, pitting, reduction of structural strength, embrittlement, change in conductivity or flexibility, bad odour and other physical or mechanical property changes.

Antimicrobial additives can counter this growth and help to retain the mechanical properties of flexible products used for roofing membranes, geomembranes, pool liners, floor coverings, gaskets in white goods and many more applications—especially in plasticised PVC products. Plastics used in pipes, window frames, and cladding (siding) can also benefit from their incorporation into compounds. Biocides used in natural fibre reinforced polyolefin composites, for example,

Main image: Work is underway at many leading antimicrobial suppliers to determine how well specific additives are at combatting coronaviruses

IMAGE: SANITIZED

Above: Sanitized says testing shows its T99-19 and T11-15 additives can provide anti-viral protection on polymer surfaces

prolong useful lifetime in automotive interior panels. Biocides are also widely used in plastics products intended for application in hospital and healthcare environments.

The pandemic effect

"The Covid-19 outbreak has served to remind us that viruses, bacteria, and other harmful agents not only represent an ongoing substantial risk to our health [and] that a disease can spread much faster than what we have seen in last few decades," says José Mosquera at the **Microbial Control Executive Council** (MCEC), a Cefic sector group involving several leading companies developing and supplying microbial control technology and solutions. "In a world with global supply chains, the risk is greater that a pathogen could circulate quicker and therefore become deadlier. MCEC member products are playing a role in addressing the spread of the virus, and that is a source of responsibility and commitment for the entire microbial control industry."

In March, US antimicrobial producer **Gelest** said it was ramping up the production of its Biosafe products to meet surging demand. These are used in numerous applications, including medical equipment and facilities, to prevent the growth of stain and odour causing bacteria, fungi, mould, and mildew.

Shiming Wo, Vice President and General Manager Life Science at Gelest, says: "Covid-19 adversely impacted the global supplier chain, resulting in long lead times for securing our packaging and raw materials. When our suppliers learned our products were being used by healthcare professionals on the front-line fighting Covid-19, they responded quickly and ensured that we could produce and deliver our products to our customers on time."

In 2019, Gelest joined The Antimicrobial Resistance (AMR) Challenge initiated by the Centers for Disease Control (CDC) in the US. It says its Biosafe antimicrobials inhibit micro-organism growth by physically puncturing the microbe's cell membrane and destroying the microbes on contact, a mode of action it claims has significantly less tendency for microbes to develop resistance through adaption and mutation.

BioCote in the UK says it has also seen a substantial increase in enquiries about incorporating antimicrobial additives into surfaces and products "to deliver the ultimate hygiene solution together with regular cleaning and robust hand hygiene." Technical Manager Megan Vaughan says a standard for virus testing introduced in 2019 led the company to explore the option of further virus testing and, in early 2020, BioCote engaged an independent laboratory to test its technology against a strain of feline coronavirus to provide continued confidence in the efficacy of the technology. As a result of this testing, the company says it was one of the first to prove that its antimicrobial technology was effective with a reduction of 90% in two hours against feline coronavirus strain Munich.

"BioCote has also been empirically proven to work against bacteria, for the expected lifetime of the treated product, as well as against mould, fungi

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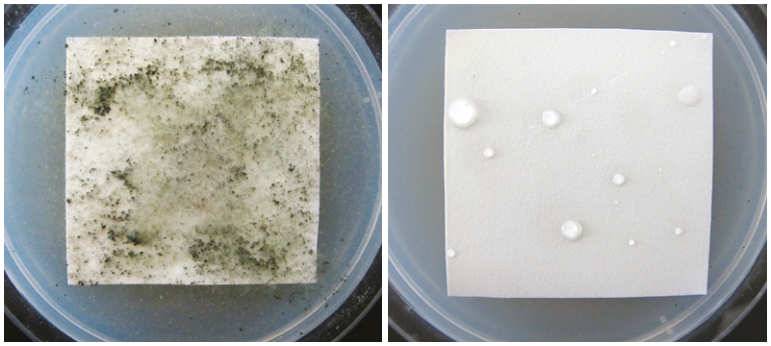

Vinyl sheet after fungal testing to ASTM G21. The left sample is untreated while the right sample contains Ultra-Fresh antimicrobial from TRA

and the influenza A H1N1 virus," says Vaughan. She says the antimicrobial technology acts as a second line of defence by actively reducing the number of microbes on a protected surface. "It works in between cleans to control the levels of microbes on those surfaces, working constantly and lasting for the expected lifetime of that product."

Swiss company **Sanitized** says tests conducted by independent laboratories have confirmed that a treatment with its Sanitized T99-19 and Sanitized T11-15 products reduces the viral load on polyester textiles by up to 99% (in accordance with ISO 18184:2019). Tests were performed using a feline coronavirus with structures and mechanisms similar to SARS-Cov2.

Sanitized T99-19 uses a patented ammonium silicate compound technology; Sanitized T11-15 utilises silver technology. The company says the additives "are the perfect tool for an antiviral and antibacterial treatment of face masks, protective professional medical clothing, bed linens, or mattresses. The formulation of both products remains completely untouched, thus ensuring that it will continue to offer outstanding protection against bacteria."

In mid-June, **Thomson Research Associates** (TRA) in the US said it had seen a 700% increase in companies interested in incorporating antimicrobial technologies into their goods in recent months. "Companies that are looking for antimicrobial technologies that can be used in food contact and potable water applications continue to be popular trends," it says. "More and more companies who are manufacturing parts for the transportation industry are coming forward looking for antimicrobial solutions to help keep interior surfaces cleaner and more durable. TRA has seen significant interest from the healthcare sector looking to incorporate antimicrobial technologies into items such as wall panels, electrical conduit tubing and other high touch surfaces."

The company, which produces Ultra-Fresh antimicrobials, says stricter environmental regulations around the world "have opened up the biocidal market to multiple players and driven innovation to help create novel antimicrobial products using new and existing active ingredients. New formulations must be environmentally-conscious while providing durable broad-spectrum performance."

Brand power

The company says it has experienced a "substantial" number of requests from current and new customers looking to add its logo to their packaging, products, and website advertising. "Instead of simply branding their good as 'antimicrobial treated', companies are increasingly looking to leverage the value of well-established antimicrobial brands, such as Ultra-Fresh, to provide customers with confidence in knowing their products will exceed the most stringent performance testing standards," it says.

Earlier this year, **Troy Corporation** announced a co-branding agreement with mobile phone case and accessory firm Case-Mate that will see its products branded with its Micropel Antimicrobial Protection logo. "Our customers have expressed interest in antimicrobial protection in Case-Mate products," says Case-Mate CEO Steve Marzio, who says that interest has spiked in recent months.

Troy Vice President Marketing Dr Frank Cangelosi says the company has been offering its Micropel products for plastics applications for nearly 20 years and claims the brand is recognised worldwide for safe and effective protection. He adds that manufacturers that use the Micropel brand must meet various criteria and testing protocols and agree to a comprehensive quality control programme to ensure customer satisfaction.

Another antimicrobial produced with a globally-

IMAGE: CASE-MATE

Right: Phone accessory maker Case-Mate is using Troy's Micropel antimicrobials under a new co-branding deal

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IMAGE: MICROBAN INTERNATIONAL

Right: Laboratory sampling underway in the Microban International test laboratory

recognised brand is **Microban International**. Dr Ivan Ong, Vice President of Global Research & Development, with the US-headquartered company, says that designing for durability is characterising worldwide product development initiatives. "Minimal design considerations that once encouraged disposability are quickly being replaced with considered life cycle assessments. These changes are driving manufacturers to reconsider raw material choices and supply chain management, encouraging them to create more robust plastics products. There is also an increased emphasis on end-of-life recycling, products that can be repaired and upgraded, and easy-to-clean designs.

"Products with an extended functional lifetime will require more frequent cleaning and maintenance, especially when environmental conditions facilitate unwanted microbial growth that can damage aesthetics," he adds.

Repeated cleaning is not always viable, realistic, or enough to tackle a problem in isolation, says Ong. In cars, for instance, plastics surfaces can be hard to clean frequently because they are out of reach (air conditioning hoses, for example) or are subjected to constant use. "A more common example is a shower curtain, which often succumbs to unsightly fungal growth as a result of consistent exposure to moisture, soap, and skin deposits. It stands to reason that the use of antimicrobials will be a design consideration as we look to create inherently cleaner and more durable plastic products."

IMAGE: MICROBAN

Above: Bacteria cultured from a swab sampled from a multi-media remote control surface

Viral concerns

At **Radical Materials**, which produces SteriTouch antimicrobials in Wales, Craig Evans in design and marketing says many of its recent conversations with potential customers begin with the question: Is SteriTouch effective against Coronavirus?

"While several SteriTouch products have been tested against viruses such as Influenza A and feline coronavirus, a commonly used surrogate for SARS-CoV-2, it is important to bear in mind that good efficacy of an antimicrobial additive in one material should not be used to infer similar efficacy of that additive in another material," he says.

"There can be very significant variations in antimicrobial performance from one material to another, or even between apparently similar grades of the same material from the same manufacturer. For that reason, a generic claim of good performance in, for example, ABS is relatively meaningless... the test results would only apply to the specific material that was tested, even down to the pigments that were used. This applies to efficacy testing against bacteria and mould, but is particularly important for anti-viral claims," he says.

Evans says that one of the most important, but restrictive, issues in the antimicrobial sector is regulation. "The range of available active substances has been reduced over recent years and the number of options for delivering robust performance in polymers is relatively limited," he says.

"Since legitimate antimicrobial suppliers will essentially be using the same active substances, it's important to identify means of differentiation," according to Evans. He says that the level of technical understanding and support that can be provided is a particular differentiator. "The effect of antimicrobial additives on the properties of a polymer can be significant, from the visibly obvious such as discolouration or loss of clarity, through those which could easily be missed without testing, such as compromised impact strength or UV stability, to those with potentially catastrophic consequences, such as complete loss of UL94 V-0 flame retardancy. Radical has invested heavily in

IMAGE: SHUTTERSTOCK

Above: Microban says automotive interior components such as frequently-used controls and air conditioning hoses can benefit from antimicrobial protection

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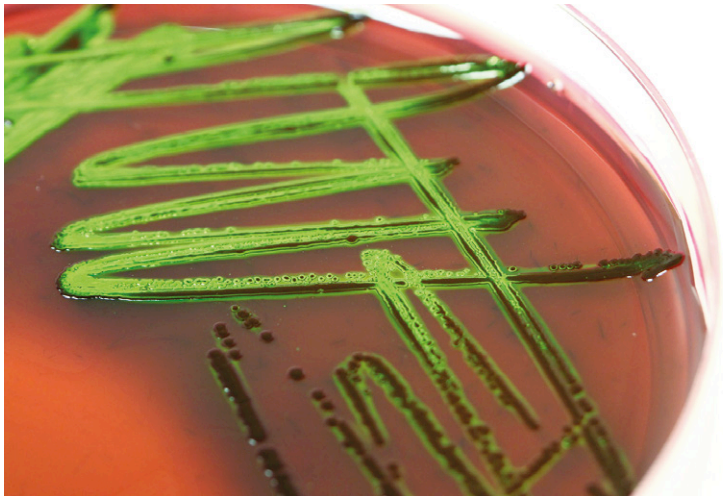
IMAGE: RADICAL MATERIALS



Above: Bacterial growth in a petri dish

materials testing equipment, ensuring such effects are identified and mitigated or eliminated during the product qualification process."

Antiviral revival

Takao Kato, Associate General Manager, Global Sales and Marketing at **Sinanen Zeomic** in Japan, which claims to have commercialised the world's first silver-based inorganic antimicrobial technology back in 1984, says that since the beginning of the Covid-19 pandemic, the antimicrobial and antiviral industry has seen upwards of five times the normal volume of technical enquiries seeking information and technology samples. "With the outbreak of Covid-19, the antiviral industry has seen rapid revival and expansion together with calls for stronger and better antiviral solutions," he says. This has triggered increased demand for antimicrobials. "We expect this trend is likely to continue for a few years."

Zeomic technology uses silver, zinc, or copper ions embedded in a zeolite ion-exchanger to impart antimicrobial properties to the resulting material [Figure 1). It is available as a powder in different particle sizes and can be compounded into plastics and coating materials in in a similar way to inorganic pigments. Its innate heat resistance enables the technology to be easily kneaded into general-purpose and engineering plastics, says Akio Taniguchi, Associate Director, Research & Development.

Zeomic has been subject to "immense" volumes of safety testing and has a proven track record of world-class safety, Taniguchi adds. "In recent years, Zeomic has been favourably positioned as a go-to solution for medical-grade devices, such as catheters."

Zeomic offers not only antimicrobial properties to combat bacteria but is also said to be effective in virus inactivation. "At present, although Zeomic is not filed as an EPA-certified antiviral agent; we are now exploring such a potential registration in light of market demand and by way of accumulating antiviral efficacy data," says Taniguchi. "We were also able to confirm that Zeomic offered a viral inactivation effect at a relatively low concentration. However, such inactivation results are from Zeomic in its raw powder state [Figure 2]. In order to ensure efficacy in real-world scenarios, a suitable concentration and processing method need to be determined. Lastly, stringent antiviral testing using prototype products is necessary to confirm and evaluate the efficacy."

Frequently-touched surfaces such as hand-rails and straps in public transport have been singled out as highly likely points of infection transmission, notes Taniguchi. "Antiviral processing for such may well reduce the infectivity of aggressive viral strains such as this year's Covid-19. We expect that [demand for] similar antiviral treated articles will continue to increase in the near future."

Covid-19 inevitably focused the plastics industry on antiviral technologies, as well as other hygiene

Figure 1: Antimicrobial test results on PE film containing Zeomic antimicrobial (ISO 22196)

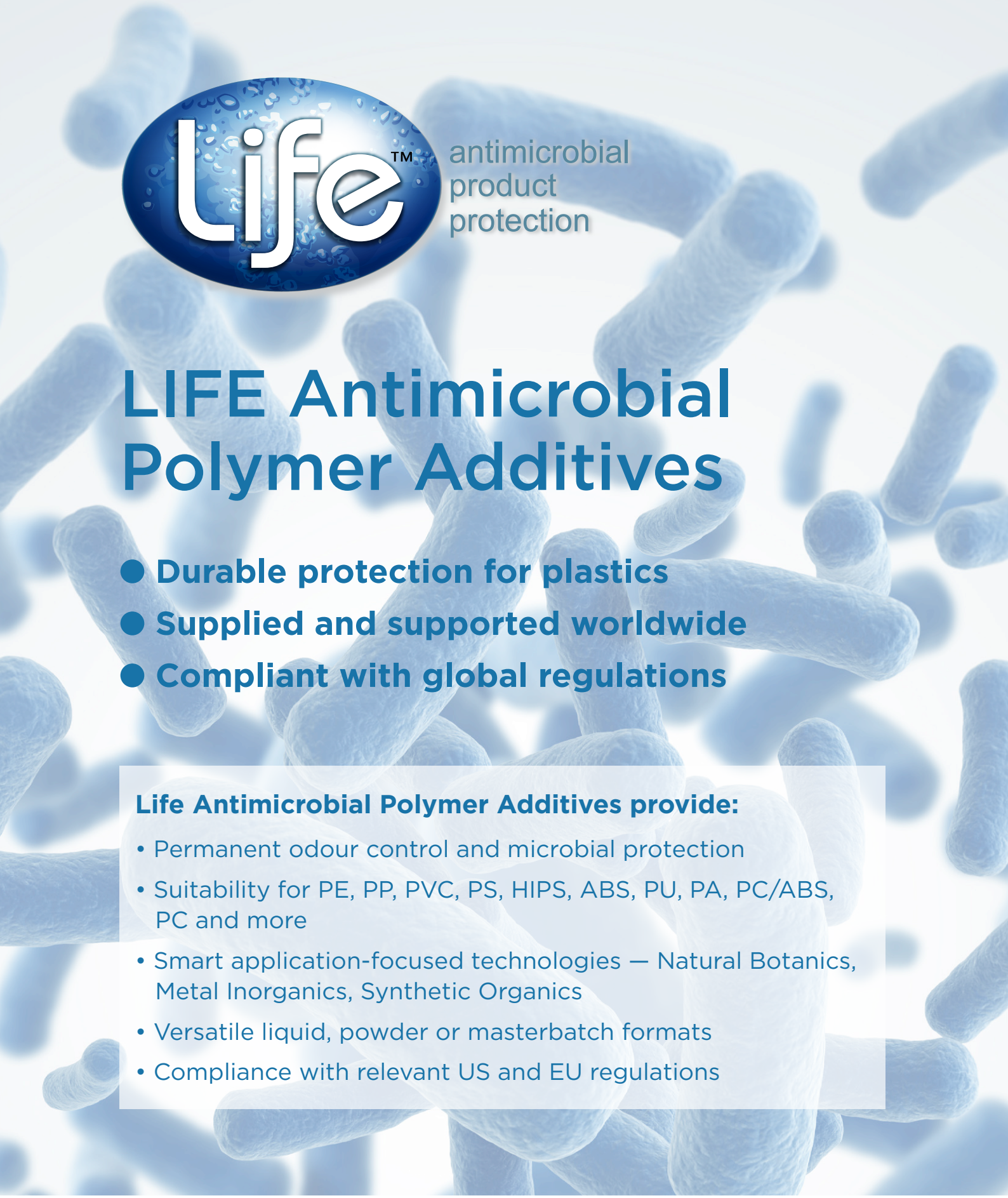
	Staphylococcus aureus		*Escherichia coli*	
	Viable bacteria count	Antibacterial activity value	Viable bacteria count	Antibacterial activity value
No additive	2.9×10^3	–	5.8×10^5	–
0.5% Zeomic	<10	>3.6	<10	>5.9

Source: Sinanen Zeomic

Figure 2: Inactivation rate of SARS after exposure to Zeomic antimicrobial (powder form)

	Inactivation rate of SARS		
	2h	4h	6h
Zeomic 375 µg/l	100%	100%	–
Zeomic 188µg/l	50%	50%	100%

Source: Sinanen Zeomic



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Right: Life Material Technologies says it has expanded its range to provide improved antibacterial protection in transparent polymers

technologies, says Tom Ellefsen, Chief Executive of **Life Material Technologies** in Thailand. "Traditionally, hygiene materials have been assessed for antibacterial activity in accordance with ISO 22196 (non-absorbent materials such as plastics) and ISO 20743 (absorbent materials such as textiles). Fortuitously, in 2019, the International Standards Organization finally also added the antiviral testing standards ISO 21702 (non-absorbent materials such as plastics) and ISO 18184 (absorbent materials such as textiles). This gives the industry clear benchmarks when assessing antiviral and antibacterial technologies."

Many of the chemistries already registered with regulatory agencies for use as antimicrobials in plastics have also been found to accelerate inactivation of viruses, says Ellefsen. "In particular, published studies find that copper ions and silver ions have potent effect against a broad spectrum of viruses. Our inorganic additive LIFE CI/AM-00-1A contains high loadings of both copper ions and silver ions and is registered for use in plastics both with the US EPA and under the EU's BPR. In screening tests, LIFE CI/AM-00-1A delivered stronger antiviral activity than similar additives containing only silver ions and zinc ions."

Ellefsen also notes that scientific literature confirms the antiviral properties of the organic biocide bis(2-pyridylthio)zinc 1,1'-dioxide, which is supplied by Life Material Technologies under the name LIFE CP-00-1A, and the plant extract peppermint oil, which the company supplies in a number of EPA/BPR compliant formulations for the plastics industry under the Life Natural brand.

Rewriting the rules

Swiss company Prodir is renowned for the style, design and premium materials used in its pens. It recently stepped that attention to detail up another step by making its Prodir DS and QS models available with antibacterial surface protection. Both ranges use silver-based antimicrobial technology from UK-based Addmaster. "Biomaster technology tested and certified to ISO 22196 provides durable and effective surface protection 24/7 for the lifetime of the pens," says Addmaster.

› **www.addmaster.co.uk**

IMAGE: LIFE MATERIAL TECHNOLOGIES

Transparent gains

Life Material Technologies has also continued to improve its offering of antimicrobial additives for transparent polymers, adds Ellefsen. "While decent alternatives have been available for low-processing temperature plastics, inorganic additives causing clouding and discoloration have been the only alternatives for high-temperature polymers such as PC, PCTG and PET. Using both organic and inorganic actives, Life Material Technologies has now developed products for such polymers that can deliver antifungal or antibacterial activity with much improved clarity and colour."

Julie Simmons is Product Manager for Bactiglas antimicrobial products at **Wells Plastics**, a UK-based specialist additive masterbatch manufacturer. The products are based on silver and available in multiple carriers. "Until now, the benefit of antimicrobial properties has been recognised only in certain settings such as healthcare, but with greater public and media awareness of microbes and viruses it has reached a wider audience," she says. "Interest in the Bactiglas range of products has mushroomed. Manufacturers are interested in adding an 'in-built' antimicrobial property to their product, be that packaging film, hospital equipment or common touch items such as light switches."

Simmons also highlights the challenges the EU's Biocidal Products Regulation imposes on the antimicrobial sector. While supporting its aim of ensuring biocides are safe for human health and the environment, she says reviews of new products can take several years and are very costly, which acts as a brake on innovation. The situation can be even more difficult for masterbatch companies "as they sit between the active substance supplier and the finished article producer while still having to comply and stay up to date with regulations." ›

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A further challenge posed by the BPR is "non-approval" of additive systems, Simmons says. Some silver systems (not those used in the company's Bactiglas range) have been non-approved due not to health or environmental concerns, but because the Biocidal Product Committee (BPC) ruled their efficacy had not been demonstrated. "Thus, it is important that any company making antimicrobial claims, be they antibacterial or antifungal (or for that matter antiviral), is able to support such claims with robust data to avoid falling foul of the BPR," she says.

Simmons adds that zinc pyrithione, an additive commonly used in plastics (and also one of the most widely used active ingredients in dandruff treatments), could well become a casualty of the BPR. "Zinc pyrithione has been reclassified as Reprotox Cat 1B and thus it now falls under the exclusion criteria listed in Article 5 of the BPR," she says. "This means it should normally not be approved, unless one of the conditions for derogation set in Article 5(2) of the BPR is met. Zinc pyrithione is waiting to be reviewed to determine if it meets these derogation conditions. Even if it does, we still don't know what risk mitigating measures may be imposed with regards its use."

Cautious approach

While Covid-19 is at the forefront of everyone's mind, Simmons warns that claims of anti-viral performance of products should be approached with some caution. "Unlike bacteria and fungi, viruses cannot multiply on a surface as they cannot reproduce outside of a host cell," Simmons says. "Also, outside of a host cell they undertake no cellular activity and thus do not offer the multiple sites a biocide typically interacts with to produce a biocidal effect. If viruses are present on a surface, they are inactivated by denaturing the capsid protein shell or the glycoprotein envelop. This is readily achieved by the use of surface-applied disinfectants."

Wells Plastics said in June that there is some limited evidence that encapsulated antimicrobial additives can reduce virus numbers "but typically high concentrations are needed, and no-one yet has test data against the Covid-19 virus."

Netherlands-based **Parx Materials**, however, announced in early June that independent tests executed following ISO 21702 and using the Human Corona E229 virus showed that its Saniconcentrate (a modified polymer concentrate that carries trace element of zinc and was originally developed to combat bacteria, moulds, and fungi on plastics) also shows a significant effect against this virus.

"The technology is reducing the virus five times faster than on normal solid plastic surfaces," says company CEO Michaël van der Jagt. He adds that the technology also brings down the H1N1 virus by 99.99% in just eight hours in textiles fabricated with the technology. The virus tests were not executed with the Covid-19 virus as this is currently prohibited for commercial laboratories but the E229 coronavirus has a number of similarities.

Van der Jagt says the incorporation of zinc in Saniconcentrate is achieved using a patented method and says the use of zinc was inspired by the defence mechanism in the human skin "where the trace element is vital for a healthy immune system."

This month, PA66 producer **Ascend Performance Materials** said it had submitted its first FDA

EU biocide rules create 'a maze'

Aside from their protective properties, microbial control technologies can play a role in supporting the policy objectives set out by the European Commission's Green Deal initiative, which emphasises the need to manufacture products that avoid unnecessary waste, according to industry trade association Microbial Control Executive Council. However, in the EU at least, it argues that regulation is making it increasingly difficult to develop such solutions.

The MCEC biocides and biocidal applications in the EU are principally regulated by the Biocidal Products Regulation (BPR). This addresses the placing on the market and the use of biocidal products containing active substances used to protect humans, animals, materials, or articles against harmful organisms such as pests or bacteria.

The BPR aims to improve the functioning of the biocidal products market in the EU while ensuring a high level of protection for human health and the environment. Its approach involves authorisation of active substances as well as the products they are used in.

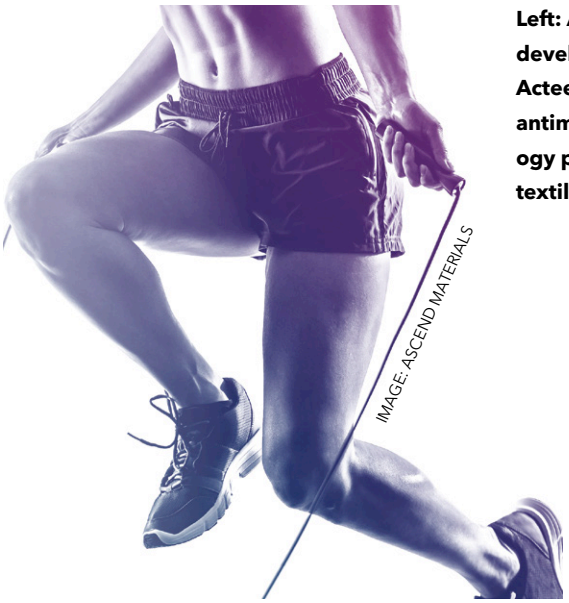
"In theory, this two-fold approach makes sense, as it provides regulators with a very high level of certainty on the safety of what workers, consumers or the environment could potentially be exposed to. In practice, the regulation has reached a level of complexity which has turned it into a maze for companies to operate with," says José Mosquera, MCEC Chairman and Global Industry Leader for Industrial Preservation at DuPont Microbial Control.

› **www.microbial-control.com**

510(k) for clearance to market its patent-pending Acteev antimicrobial technology in a surgical mask in the US under a new brand called Acteev Biodefend. Previewed at K2019, its Acteev technology embeds zinc ions in the polymer. The company says that independent laboratory testing has found the materials to achieve greater than 99% efficacy at deactivating bacteria, fungi and viruses, including SARS-CoV-2.

"We've partnered with independent labs for comprehensive testing and have reallocated resources to ready ourselves for world-scale production upon receiving regulatory clearance," says Vikram Gopal, Ascend's Chief Technology Officer.

The company says Acteev Biodefend technology has been shown in laboratory tests to deactivate SARS-CoV-2, the coronavirus that causes Covid-19, and other pathogens including H1N1, coronavirus 229E and Gram-positive and Gram-negative bacteria such as staphylococcus and E coli. Acteev technology has been tested in multiple end forms, including knit and woven fabrics; engineered plastics; and nanofibre, meltblown and spunbond nonwoven materials.



Left: Ascend has developed its new Acteev zinc-based antimicrobial technology primarily for PA textile applications

The acid test

Austrian company **AMiSTec** develops and licenses technology for maintaining germ-free surfaces based on Lewis acids. Peter Guggenbichler, the company's founder, says that self-sanitising surface technologies are a solution to hospital-acquired infections but that these have to be created with

Seafood gains from Parx technology

Antimicrobial technology from Parx Materials eliminated fouling on plastic tanks used to farm abalone shellfish. These images show the results after six months in the sea (both were new at the outset)

Antimicrobial technology developed by Parx Materials has proved its value in production of farmed abalone, a premium marine mollusc popular with discerning diners around the world.

Abalone are farmed in plastic culture tanks that are immersed in the sea for around six months, over which period they typically get covered with growth of other aquatic species that obstruct the flow of fresh water the shellfish require to grow. One marine aquaculture farm recently replaced a number of its tanks with some produced using Parx Materials' Saniconcentrate. These protected tanks remained unfouled when removed from the water for harvesting and the abalone were said to be larger and better developed than those grown in the traditional type.

"This is an antifouling solution that does not leach out and does not contaminate the oceans," says Parx Materials CEO Michaël van der Jagt. "Nothing of the technology is 'consumed' over the lifespan of the product, so it remains at full strength."

The elemental zinc used in the Saniconcentrate does not kill bacteria, van der Jagt explains, but stops it attaching to surface. "It prevents adhesion, so the bacteria cannot take up nutrients, and so cannot proliferate," he says, adding that because Saniconcentrate does not kill the bacteria it is not categorised as a biocide and so is not covered by the BPR.

Van der Jagt says it has taken the company several years to develop its dispersions of elemental zinc in thermoplastic carriers, enabling efficacy levels of almost 100%. "Processors can now create surfaces where bacteria cannot attach anywhere," he says.

Parx Plastics sells Saniconcentrate directly to moulders and extruders and provides usage advice. The concentrate has a 3% loading of the active ingredient, leading to a concentration in the final product of under 1 ppm, he says. The company makes Saniconcentrate at its plant in Italy and also uses toll compounding. It is currently substantially increasing capacity, which at the time of writing stood at around 10 tonnes/month.

› **www.parxmaterials.com**

the correct technology. "I have been involved for 30 years in the care of an uncountable number of children with hospital-acquired infections and multidrug resistant microorganisms. We are approaching the post-antibiotic era." He points to a report last year from the United Nations Interagency Coordination Group on Antimicrobial Resistance, which warns of a "potentially catastrophic drug resistance crisis. If nothing is done, drug-resistant diseases could cause 10m deaths each year by 2050."

Surfaces incorporating metal oxide Lewis acids have shown strong antimicrobial activity, Guggenbichler says. "This technology is the only one which meets all the requirements for prevention of hospital-acquired infections: no induction of resistance, no allergenicity," he claims. "The additives are essential trace elements in the body. Easy cleaning has been documented, even with water, as microorganisms don't adhere on acid surfaces. The technology is also active against microorganisms embedded in a biofilm." He says the technology is approved in the BPR.

The Material Protection Products (MPP) business unit of **Lanxess** in Germany has several biocides for protection of various polymers and polymer compounds, including flexible PVC, polyurethanes, silicones, and silane-modified polymers, and compounds reinforced with natural fibres under the brand name Biochek. They vary according to the carrier and the level of active ingredient (AI). A company spokesperson says latest additions to the portfolio include Biochek 8071 P-SB (9% AI in a flexible PVC carrier) and Biochek 8064 P-SB (18% AI in DOTP), both of which are said to have pronounced antibacterial properties.

Combined appeal

"As a general principle, Lanxess recommends the use of products based on combined active ingredients, like the Biochek series," says the company. "The rationale of employing combined actives as opposed to single-active based products is a significantly enhanced spectrum of activity against microorganisms and the significant reduction of the risk of formation of resistant organisms as at least two mode of actions are in effect."

The synergistic effect of combinations used in key Biochek grades such as TBZ (terbuthylazine) and IPBC (iodopropynyl butyl carbamate) can also mean lower dosage levels and the potential to save cost. "The optimum dose level per product/application should be established by microbial lab tests (e.g. ASTM G 21 or ISO 846 B) with optional pre-aging according taking into account the specific applica-

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IMAGE: SHUTTERSTOCK

Above: Many antimicrobial applications require high quality tactile and aesthetic properties, says Americhem

tion requirements," the company advises.

Lanxess earlier provided single actives to the plastics industry. It says tightening regulatory requirements such as the OBPA phase-out and the "candidate for substitution concept" in the EU prompted it to develop a portfolio of biocidal combination products centring around TBZ. It says TBZ has a good toxicity profile featuring excellent biocidal performance as well as regulatory sustainability.

All actives contained in Biochek are supported under the BPR in the EU with registration pending on the two new grades. Products are marketed in the EU, APAC, and the US.

A particular concern to the PVC industry is the compatibility between heat stabilisers and biocide which, if not selected correctly, could lead to reduced functionality. **Valtris** is a leading producer of both heat stabilisers and biocides for PVC, which it believes makes it well positioned to address this challenge. The company says it has performed multiple studies in order to optimise the use of biocides in PVC applications together with heat stabilisers without compromising performance. Specific heat stabilisers have been developed that are highly compatible with DCOIT and OIT–it cites its Lankromark LZB996, LZB974, LZB1007 products as examples that have been optimised to work effectively with isothiazolinone technology.

Custom solutions

Masterbatch maker **Americhem** says, with the increased awareness around the world regarding microbes and the safety of everyday products and surfaces that we come in contact with, it has become more involved in developing custom multi-attribute masterbatches and compounds involving antimicrobials over the past couple of years. "These products often combined performance attributes, aesthetics, and antimicrobial properties," it says. "We have also expanded the range of antimicrobial offerings to silver, copper, organics, and natural solutions."

In Spain, **Tolsa Group** has developed its Adins Protection additives based on what it says is a new environmentally-friendly inorganic technology that offers high versatility and compatibility in different systems. The additives are based on a variety of active substances including silver salts and different metals, and are said to generate powerful biocidal, fungicidal, and algicidal effects.

"All products are based in a needle-like special silicate with specific active substances," says a Tolsa spokesperson. "The materials were developed several years ago and we are now in a continuous development improving our family with different combinations of active substances, metals, etc. Our technology allows a control of the release of metals and an optimal dispersion in the matrix in which it is incorporated, which translates into a high antimicrobial activity."

Meanwhile, **Symphony Environmental Technologies** in the UK says it has obtained approval from the US Food & Drugs Administration (FDA) covering its d2p antimicrobial technology for use in LLDPE film for wrapping bread. The technology is intended to inhibit the growth of bacteria on the surface of packaging. Symphony says the d2p additive is synergistic with its d2w degradable technology. "We therefore expect to see considerable interest in d2p for use in bread packaging," the company says.

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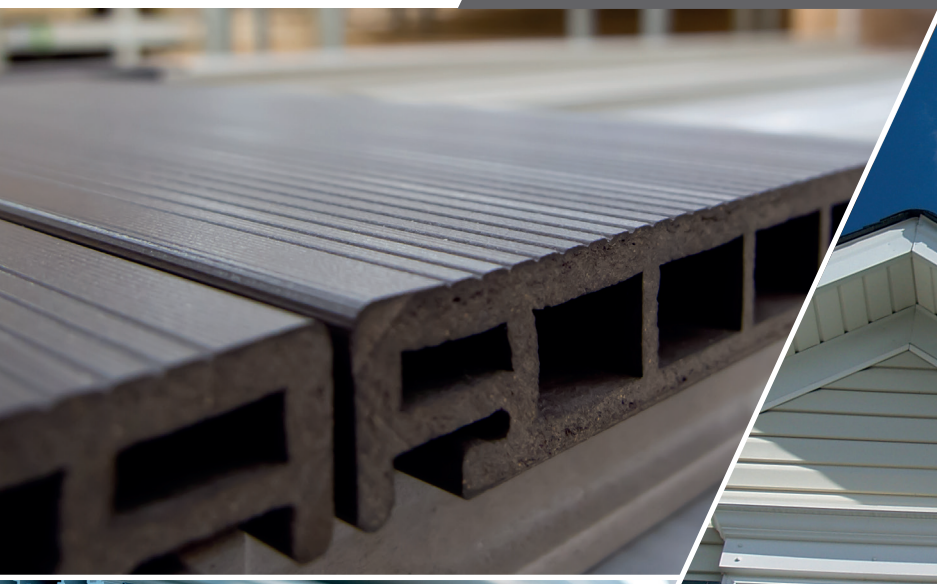

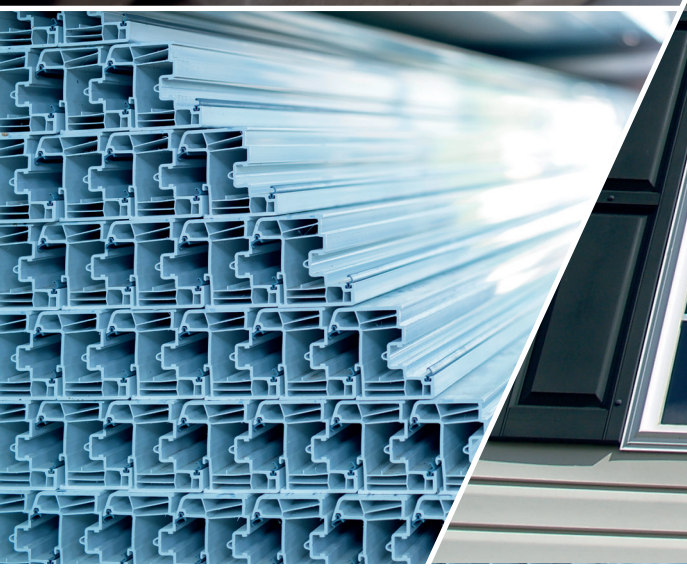

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As more compounders look to handle recycled feedstocks, effective melt filtration will become increasingly important in maintaining product quality. ***Peter Mapleston*** *reports*

IMAGE: GNEUSS

Melt filters take on the recycling challenge

Melt filters are a key component in many plastics compounding and extrusion systems but especially in those where recycled polymers are being processed, which will become an increasingly common likelihood as markets adapt to the concepts of the circular economy. Melt filtration systems are able to remove all sorts of contaminants, including paper, wood, sand, glass, and metals, as well as some non-melting plastics. They can handle recycled materials from a wide range of sources, with much of the more recent development work among filtration system suppliers concentrated on improving the quality of melts containing post-consumer recyclate (PCR).

"To achieve high quality pellets at the end of the recycling process, the right filtration technology should be chosen based on the input materials," advises Robert Obermayr, Head of the **Powerfil** business unit at Erema.

The Austrian plastics recycling systems maker established its Powerfil operation three years ago. It says it wanted to offer melt filters to the industry that it had already proven as individual components in its systems (a number of modifications were made to the system filter systems to suit the Powerfil market). Its SW RTF partial surface backflush filter system and Laserfilter are both individual components and are compatible not only with Erema extrusion systems but also those of other suppliers.

The company says that cyclical filtration using wire mesh filters in a piston screen changer is typically appropriate for contamination levels of up to around 0.05%, while continuous filtration using a laser filter is able to process contamination levels of 3-5 %.

For its wire mesh filters, Erema uses piston screen changer systems with back flushing. Each piston carries two filter cavities in which the wire mesh screen packages are inserted. "This system involves a cyclical process providing excellent

Main image: Developments in melt filters aim to enable more heavily contaminated material to be processed with higher yield, reduced downtime, and improved process consistency


IMAGE: EREMA

Above: The SW RTF filter from Erema's Powerfil division is a partial surface backflush design

filtration options down to mesh sizes as small as 32 microns and even smaller," says Obermayr. "Because the filter is made out of woven wires it provides high porosity, which means that it has a high proportion of open area per unit of surface area."

Erema wire mesh filter systems start with one piston and two screens and go up to six pistons and twelve screens. "With the six-piston screen changer the melt pressure difference during backflushing is extremely low," says Obermayr. "Only one out of twelve screens is in backflush mode while the other eleven screens are in full production."

State-of-the-art

For its laser filters Erema uses a special hard steel plate in which the filtration holes are manufactured, as the name implies, using a laser. Obermayr says these systems represent the state-of-the-art in terms of continuous melt filtering. As holes get blocked by contaminants, a scraper movement is actuated to free them. Each screen has three scrapers, and wiping occurs on a virtually continuous basis. According to Obermayr, this ensures a high proportion of open area, which enables a high throughput even with very contaminated materials.

Laser filters are known to provide continuous filtration at very stable pressure levels and are capable of supporting uninterrupted periods of operation lasting many days or even weeks. They also provide a very short residence time of contaminants on the filter media compared to mesh screen filters, where the particles will not be removed until the next periodic backflush. "The filtration fineness can go as low as 70 microns, although in many cases a direct comparison of mesh filters and laser filters shows that the laser filter screen provides a better-defined hole-geometry which ensures a better classification efficiency," says Obermayr.

Erema calls its filtration system that adjusts automatically and which allows for filter changes while the extruder continues to operate as "Lock and Change". In these a valve system allows the laser filter screen to be changed on one filter head while the other filter is in full production.

Erema melt filtration systems feature screens with large surface areas to prevent pressure spikes. "The filters are easily accessible so that they can be reached quickly, and our intuitive HMI helps the operator to interact with the system," Obermayr claims. "Any wear components in the system are easily accessible to minimise down time and eliminate complex training requirements for operators."

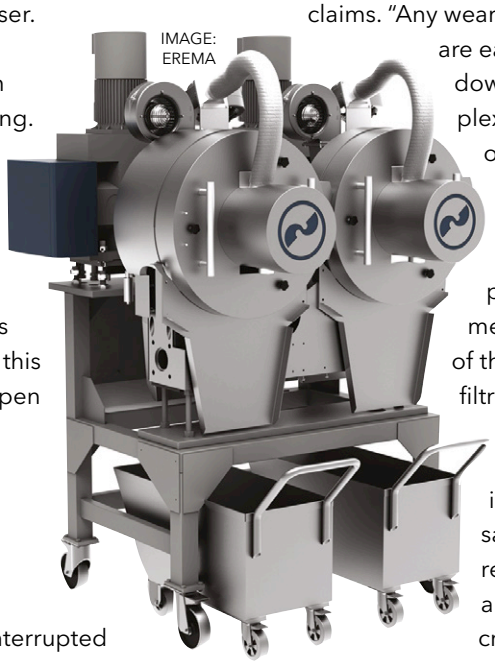
IMAGE: EREMA

Right: Erema describes its Laserfilter as a state-of-the-art melt continuous filtration solution

At Italian machinery manufacturer **Fimic**, Sales Director Erica Canaia also points to increasing requirements for processing PCR. "One of the important issues in melt filtration today is that the post-consumer recycling market is improving and increasing worldwide," she says. "Better technology is required for high-end recycling applications and filtration is a critical step to obtain high-

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Right: Gneuss says filters such as it RSFgenius can maintain process consistency at high contamination levels

quality pellets from post-consumer waste."

Canaia points out that PCR melt streams can differ significantly depending on the material's origin, sorting, and pre-treatment. Prime customer considerations include increased throughput capabilities and reductions in operating costs. "Melt filters need to be automatic and able to reprocess contaminated materials on a continuous basis," Canaia says. "They must be simple to use and to maintain, as well as efficient. After China's 'green fence' was created, we saw higher levels of plastics waste worldwide with more aggressive contamination, which conventional technologies were not able to handle. We have developed technologies that can meet these requirements and be customised for any recycling extruder."

Taking on PVC

One of the latest developments at Fimic is a filtration technology applicable to recycling of flexible and rigid PVC. "This is a breakthrough, because until now no continuous scraping technology could be applied to recycle PVC waste constantly," says Canaia. "In terms of filtration, the only option PVC recycling companies had was either a slide plate screenchanger or a continuous mesh changer…PVC is a very sensitive material and easily degrades with higher residence times in the melt filtration process."

Canaia says that using Fimic's PVC filtration technology, no degradation takes place during the melt filtration phase. The company has collaborated with a number of extruder suppliers and has implemented adaptations to its existing RAS technology to achieve this, including special hardening treatments on filter parts to provide greater corrosion resistance. In addition, some components have been modified internally to enable higher melt flow. The filters were tested for two years before installations began.

Below: The latest variant of Fimic's RAS design brings continuous scraping laser filter operation to PVC processing

Fimic recently installed a melt filter for a German company recycling flexible PVC from garden hose. This involved 150 micron laser filtration, which replaced the 400 micron mesh filter installed on the previous filtration system. In a second example, the installation of an RAS400-PVC filter enabled intervals between screen changes to be increased from 15 minutes to four days on a line processing 450-500 kg/h.

The company says it also now plans to assess the applicability of its technology for recycling post-consumer PET fines, which typically contain much more contamination than classic PET flakes.

Focused on quality

At **Gneuss**, Regional Sales Manager Andrew Prangnell also points to the drive to put post-consumer recycled material into high-quality final product—sheet and film being primary examples—where until recently only 100% virgin material would have been used. "But the process requires fairly fine filtration. Original equipment filtration, designed with processing virgin material in mind, very quickly becomes a bottleneck," he says.

"When processing recycled material into film or sheet, it is important that nothing is done to interfere with the stability and continuity of the process. If processing recycled materials leads to disruption and production interruptions, then the replacement of virgin material with recycled material is simply not viable," he says.

Prangnell says that typical screen changers offered for processing recycled material were originally developed for repelletising applications and are not so suited to final products. "Process and melt pressure stability are of far less importance when processing material to pellets than when manufacturing a semi-finished product such as sheet or film," he explains.

"Gneuss offers a range of melt filtration systems which offer both the ability to deal with high levels of contamination whilst at the same time maintaining extremely high levels of process consistency—for example, pressure variations of less than 4 bar during operation, together with 100% availability and a patented self-cleaning technology with unparalleled efficiency," he claims. ›

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The new FlexDisc filter stack from Nordson showing the complete stack (above) with two of the internal screenpack components

IMAGE: NORDSON CORPORATION

Nordson Corporation has developed a filtration device that, according to BKG Business Development Manager Tobias Walcesky, substantially reduces material loss from backflush screen changers when used in the compounding and recycling of PET.

Backflushing is a self-cleaning feature in which a small portion of the melt is discharged in the reverse direction back through a screen to remove contaminants. It is automatically initiated when the pressure differential caused by contaminant build-up increases to a pre-set level. In one of Nordson's BKG HiCon V-Type screen changers with four screen cavities, for example, this backflush process is performed in one cavity after another, allowing melt flow to continue through the other three cavities.

Reducing losses

To cut back on the material lost during backflushing, Nordson has developed a filter stack that replaces the standard screen in each cavity. Each of these filter stacks consists of two to four FlexDisc cassettes, with two screen packs in each cassette. This substantially increases filtration area and reduces material loss by reducing the amount of polymer used in the backflush cycle and the number of cycles needed in a given period of time.

The potential for cost savings is considerable, says Nordson. "In recycling, for example, if a ton of PET bottle flake sells at $1000 (around €920) annual material losses with a standard backflush screen changer with flat screens operating 24/7 can add up to more than €100,000. The BKG FlexDisc filter stacks can reduce such losses by more than 50%."

In operation at one PET recycling company, for example, a BKG HiCon V-Type screen changer equipped with FlexDiscs is said to have provided more than double the filter area versus a comparable standard unit. The FlexDisc-equipped screen changer recorded 239kg of material loss per day, compared with a daily loss from the standard unit of 680 kg. The materials savings amounted to 65%.

At K2019, Maag Group company **Ettlinger** unveiled its largest ERF continuous melt filter for ultra-high throughputs and removing difficult contaminants. The ERF 1000 has four filter drums that together provide a filtration surface of 6280cm², twice as much as on its previous range topping ERF 500 model (which has the same footprint). It can handle feedstock containing up to 18% contaminants on lines with outputs of up to 10,000 kg/h, depending on the application.

"The filter is Ettlinger's response to the accelerating industry trend in many parts of the world toward higher throughputs on the one hand and even higher qualities on the other—a trend triggered by the rising global demand for premium quality recycled materials for sophisticated applications," says the company.

"The large filtration surface, along with our 60 µm (230 mesh) screen size—which is now also available for all Ettlinger filter models—enables qualities that were previously out of reach. High quality film recycling will greatly benefit from the ERF1000 capability. The ERF's high processing reliability, coupled with a powerful control system that was designed with maximum user friendliness in mind, means that only minimal human resources are tied up," according to the company.

Ettlinger ERF filters, which are self-cleaning, work with a rotating, perforated drum, through which there is a continuous flow of melt from the outside to the inside. A scraper removes the contaminants held back on the surface and feeds them to the discharge system.

A new feature introduced on the ERF 1000 allows the four filter drums to be replaced individually without disrupting production. This means the device can run continuously and fully automatically, often over a period of several months at a time, with advantages such as ultra-low melt losses and

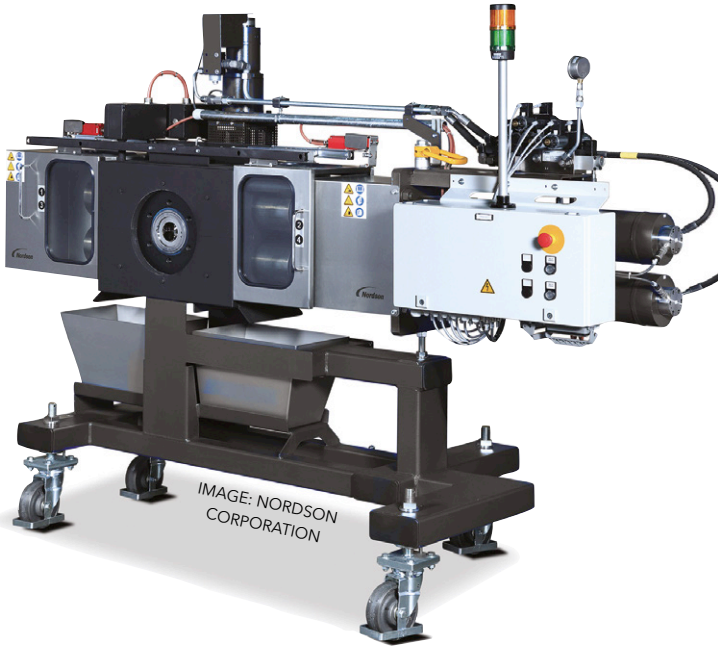

IMAGE: NORDSON CORPORATION

Right: A BKG HiCon V-Type 3G screen-changer with FlexDiscs delivered a 65% material saving for a PET recycler

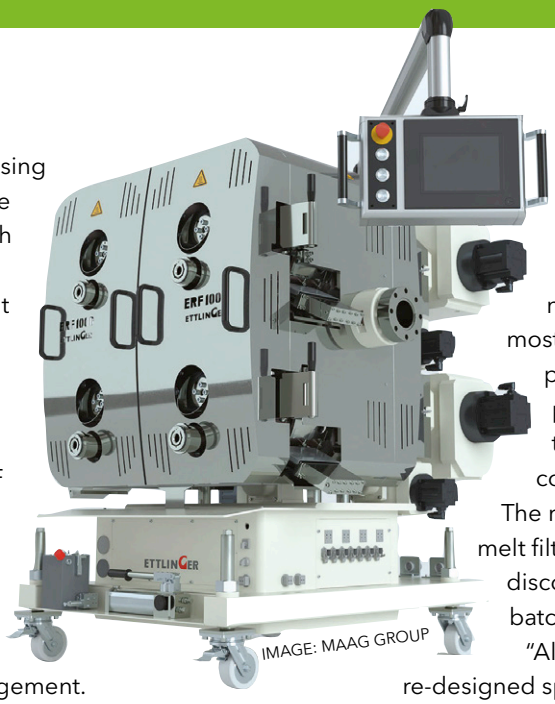

IMAGE: MAAG GROUP

Left: The ERF 1000 is the latest and largest high performance melt filter from Maag Group company Ettlinger

good mixing and homogenising of the melt. The large surface area of the drums, along with the continuous cleaning principle employed, makes it easier to check the process pressures and guarantees a constant pressure during operation. Existing Ettlinger filter owners that buy an ERF 1000 will, in the future, be able to profit from compatible wear parts such as screens, frames, and scrapers, leading to simplified spare parts management.

Compound options

Aside from its Ettlinger developments, **Maag Group** says it is supporting compounding processes with an updated melt filtration product portfolio. "Melt filtration is a decisive system component for a high output, high quality compounding line," says the company. "Besides their main task of removing contaminants and gels from the polymer matrix, filter systems help to homogenise the material."

The company claims it now has "the industry's most comprehensive product portfolio of melt filtration products and can respond to a wide variety of compounding applications." The range includes continuous melt filters and various types of discontinuous melt filters for batch processes.

"All melt filters have been re-designed specifically with market and customer needs in mind," says Maag. "Requirements are met by a large number of options, which can also be combined with one another."

Maag's FSC flat slide technology covers a wide range of viscosities and temperatures, for low-viscosity polymers, such as hot-melt adhesives. It incorporates a metal hybrid sealing system and can handle temperatures up to 320°C. Meanwhile, DSC and CSC piston screen changers are available with

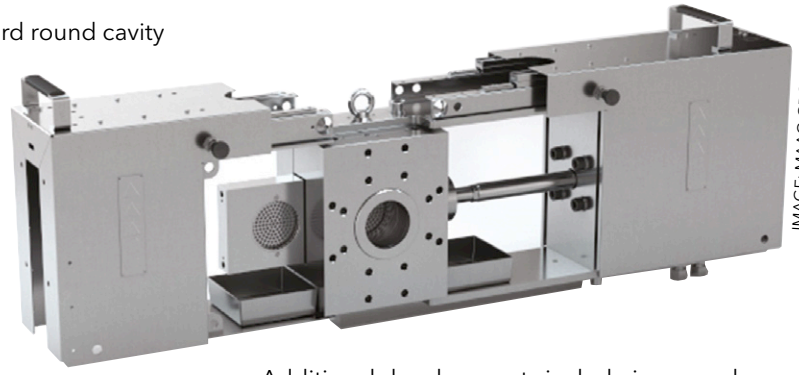

IMAGE: MAAG GROUP

Right: Maag's FSC screen changer in standard execution with stainless steel covers

three different cavities: the standard round cavity for very high filler contents; the enlarged "PE" cavity, which Maag says provides versatility in balancing throughput and filler loading; and the "R" cavity in the form of a curved sieve to realise a four times greater filter area.

Last year, **Parkinson Technologies**' Key Filters brand unveiled several refinements to its KCH continuous belt screen changer, including a more robust construction, cooling enhancements and maintenance features. "From the start [in 2012], the KCH has been a well-received high-performance machine in the continuous melt filtration market," says Justin Marriott, Key Filters Product Manager. "This recent iteration saw the most advancements since the KCH's inception." As a consequence, he says the system is now more robust, faster, more reliable, and easier to maintain.

Sensor updates

To increase overall robustness, vital machine sensors were guarded, moved further away from high-heat locations and upgraded to meet extreme production environments.

Marriott cites the puller sensor as one example, which has been upgraded from a string potentiometer to an extreme-duty, non-contact inductive sensor that has already been proven across a broad range of demanding applications.

IMAGE: PARKINSON TECHNOLOGIES

Left: The latest version of the Key Filters KCH continuous belt filter is said to offer greater throughputs and easier maintenance

Additional developments include increased cooling through the inlets and outlets, resulting in three times the flow rate compared to the previous version.

Marriott says this accelerates formation of the sealing plug, "which allows the KCH to advance the screen at an even quicker rate, thus filtering out higher volumes of contaminants and reducing the risk of downtime due to seal failure."

Marriott also says that the KCH is now more capable of reacting to unintended variations in extrusion line conditions, such as an over-ambitious increase in extruder screw speed at start-up or an interruption in the cooling water to the screen changer (which can result in the loss of the sealing plug in the screen outlet).

"The Key Filters team looked at ways to reduce potential down-time to these unfortunate situations by separating the puller and outlet assemblies. The heated polymer will bypass the puller assembly, eliminating component damage and providing an easier clean-up if plug loss occurs," he says.

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How to handle liquids

IMAGE: SHUTTERSTOCK

Feeding liquid ingredients in the compounding extruder can provide significant benefits but also brings challenges. Mark Holmes learns how to avoid the pitfalls

While most of the ingredients dosed during compounding are in solid form, liquids are also regularly used and can offer advantages in certain situations and particular applications. Liquid ingredients can mix and disperse more effectively, for example, and can deliver faster reaction times in reactive processing. However, there are also a number of issues to consider when feeding liquids in plastics compounding operations.

The most commonly used liquid ingredients used in compounding plant include additives such as plasticisers, crosslinkers and colorants, as well as monomers for polymerisation, according to **Brabender Technologie** Head of Business Development Bernhard Hüppmeier. "The main focus is on reaction processes, such as in TPU production. In these applications, highly precise dosing of the components and exact temperature maintenance are important. Digital high-resolution load cells and temperature monitoring on the heating mats and in the liquid are used for this purpose," he says.

Hüppmeier says liquids can also provide significant advantages compared with other materials, depending on the respective process or recipe. "These include better mixing in the extruder, faster reaction times, dosing with pressure, dosing with temperature, for heated liquids, as well as volume distribution at different points on the extruder."

The viscosity of liquid additives varies hugely. At 20°C, for example, water has a viscosity of one millipascal-second (mPa.s), while grape juice has a viscosity of 2-5, olive oil 100, honey 10,000 and tar 100,000. These figures change with temperature and different pressure conditions. For this reason, Brabender Technologie does not offer a wide range of standard feeders for liquids, but instead a basic feeder design that is customised to each order.

Each Brabender liquid dosing system is unique and developed for the specific material to be handled. "The decisive factor is the selection of the right pump. For this, all product parameters must be known, such as density, viscosity at different temperatures, dosing capacities, adjustment range, required product temperature, back pressure and required accuracy. Depending on viscosity and back pressure, piston diaphragm or gear pumps

Main image: Liquid additives can offer benefits to compounders in terms of dispersion but can be difficult to handle and feed

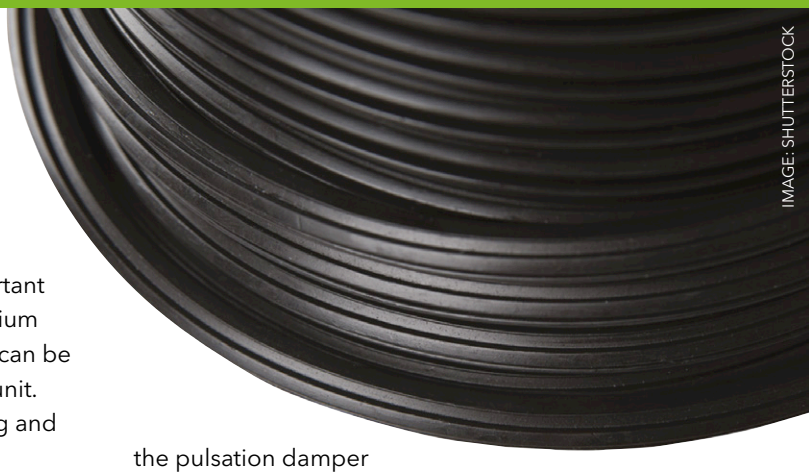

IMAGE: SHUTTERSTOCK

Right: Liquid dosing is frequently required in reactive extrusion processes such as TPU production

are used," says Hüppmeier.

"Following this a suitable measuring system, such as a loss-in-weight feeder or Coriolis flowmeter, can be specified. With heated liquids, the type of heating is important and there are two possibilities. Firstly, medium heating with a liquid—water or thermal oil—can be used with a separate temperature control unit. Alternatively, electrical heating with heating and insulating mats can be employed," he says.

Brabender advises that the liquid differential-weight scale is filled with the air vent of the weighing hopper and includes flexible connections at inlet and outlet. "A suitable hose connection from the dosing unit to the extruder must also be selected. Special attention must be paid to the pressure loss that can be caused by the length of the hose," Hüppmeier says.

A basic set-up includes the filling valve, which is designed to prevent drips, and flexible compensators located in front of and behind the weighing unit with receptacle and gravimetric load cell. The pump is attached to the lower compensator.

A Coriolis system represents a special feeding case and involves a highly accurate flowmeter integrated directly into the liquid flow piping. This would typically be used where quantities of more than 1,000 litres/h are involved and where it makes sense to use the more expensive Coriolis equipment. In system design terms, this version does not include an independent weighing system using the meter, which is positioned directly behind the pump, to determine the speed of the motor.

Pump selection

Hüppmeier says selection of the right pump is important. Piston diaphragm (membrane) pumps are generally used for low-viscosity substances. In this type of pump the piston generates a vacuum, which raises a diaphragm to allow the liquid to flow in through an inlet valve. The counter-movement closes the diaphragm and pushes the liquid through the outlet valve. The advantage of this type of pump is that the liquid to be conveyed does not come into contact with the drive mechanism—and therefore with lubricants or residues—at any point. This is important when handling hygienic materials and in many chemical applications.

One disadvantage of piston diaphragm pumps is that the switch between inflow and outflow causes a pulsating flow of liquid. Pulsation dampers can be used in processes that are sensitive to such flow. These incorporate a reservoir of gas separated from the liquid by a diaphragm. During each pump stroke some of the liquid is forced into the pulsation damper and discharged again during the suction phase, evening out the pulses.

Where the process has to be pulsation-free, several pump heads or, if feasible, a switch pump type can be used. Gear pumps can also be used, most often in processes involving medium to high viscosity liquids. They can cope with high pressures and temperatures, are accurate where low flow rates are involved, and compact at high flow rates. Brabender says it works closely with pump manufacturers to provide the optimum pump for each application. Progressive cavity pumps, control plunger pumps or peristaltic pumps are also occasionally used.

Another key feature of a liquid dosing system is the heating mechanism. Hüppmeier says that temperature is a key factor in processing and handling of liquids as it determines physical condition and viscosity. Many oils, for example, will become significantly more fluid at higher temperatures. However, some chemicals can tend to degenerate or even explode if overheated.

The use of water or thermal oil heating is a good option where waste heat from another process can be reused or where explosive substances are processed or handled. Electrical heating can also be employed, providing the advantage that each component can be individually controlled.

Whatever option is used, Hüppmeier says it must address the needs of the specific application. "For liquids that crystallise out quickly in the cold state, continuous or dead zone free heating is necessary," he says. "Otherwise, the liquid may 'freeze' at 'cold spots' and change into a solid state and the pipe can become blocked. This is particularly critical for liquids such as maleic anhydride (MAH), which cannot be re-melted after solidification. When installed above the extruder inlet, intermediate valves must be used to ensure that the liquid dosing unit cannot empty when it is switched off."

For all the previously mentioned reasons, Brabender's view is that it is very difficult to set standards for liquid feeding devices for compounding. "Almost 90% of liquid doses are

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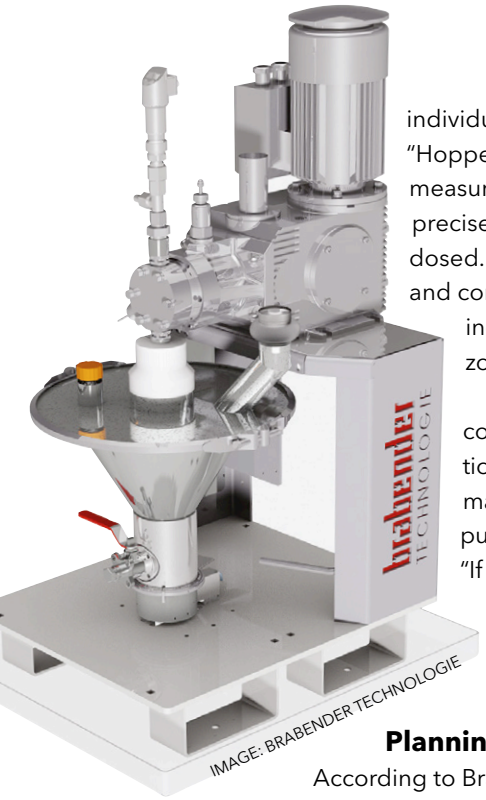

IMAGE: BRABENDER TECHNOLOGIE

Above: The FDDW-M-P liquid weigh feeder from Brabender Technologie is designed to keep costs down

individual somewhere," Hüppmeier says. "Hopper, piping, heating, weighing or flow measuring system and pump must be precisely matched to the liquid to be dosed. This also includes the filling valves and compensators. With many liquids, inerting with nitrogen and/or ATEX zones must be taken into account."

Groundwater protection is also a consideration, requiring the installation of collection trays, while filters may be required upstream of the pump to protect it and the process. "If no production stop is possible, complex double filters must be used, which can be operated and cleaned alternately," he advises.

Planning critical

According to Brabender, incorporating a liquid feeding system into the compounding process requires detailed planning in line with recipe determination and is best achieved through good communication between customer and supplier to ensure the optimal, and most affordable, technical solution is settled on.

The properties of the liquid to be fed and the production set-up requirements will determine the structure or design of the plant and the materials that can be used. Stainless steel and PTFE are durable, but individual seals and other components must be selected to match the product being handled. Special features might include, for example, mobile feeders for laboratory installations, protection for sensitive load cells, or grounding to avoid interference caused by ambient vibration.

One unavoidable consequence of the increasingly complex technical requirements of modern dosing systems is that costs for liquid weigh feeders have risen. So, for simple applications, Brabender has developed a lower-cost variant–the FDDW-M-P. In this version the weigh hopper mounts directly on the load cell and the pump mounts on a frame above the weighing hopper. This eliminates the need for pipes, elbows and the compensator, as the liquid is sucked directly out of the hopper. It offers price advantages, especially if heating is necessary.

Solids are certainly more easily handled and, from a chemical perspective, many additives can be obtained in a solid format. However, there remain a significant number that have to be handled in a liquid form, for example oils and silicones, according to **Coperion K-Tron**. It provides integrated pump solutions to cater for such materials and for complex solutions that cannot be handled using a simple volumetric pump.

Liquid challenges

The company highlights some of the more common–and sometimes unexpected–difficulties that arise when feeding materials in liquid form. "Liquids tend to be incompressible," says Keith Melton, a Sales Manager at Coperion. This is very different from solid powders and means that liquids should dose just as effectively volumetrically as gravimetrically. That, however, is not the always the case, he points out.

"Unfortunately, as flow rates and pressures increase the flow becomes less predictable because of slippage back through the pump and cavitation caused by irregular filling of the pump head. As a result, it becomes essential to provide a secondary measurement. As flow meters suffer in the same way, the best method to measure and therefore control these materials is using a precise weighing system," he argues.

"Viscosity is a challenge because when a liquid is highly viscous, it does not want to flow. This affects the type of pump that can be used. In most cases we use gear pumps because they result in a very linear flow. Depending on the material characteristics, membrane [diaphragm] pumps can sometimes be used instead," Melton says. "When a liquid is too viscous, one solution is to heat it up to reduce the viscosity. Heating systems can be incorporated in the feeder to keep the liquid flowing as it is fed into the process."

When feeding liquids, the specific requirements of each application can vary widely. "Due to the

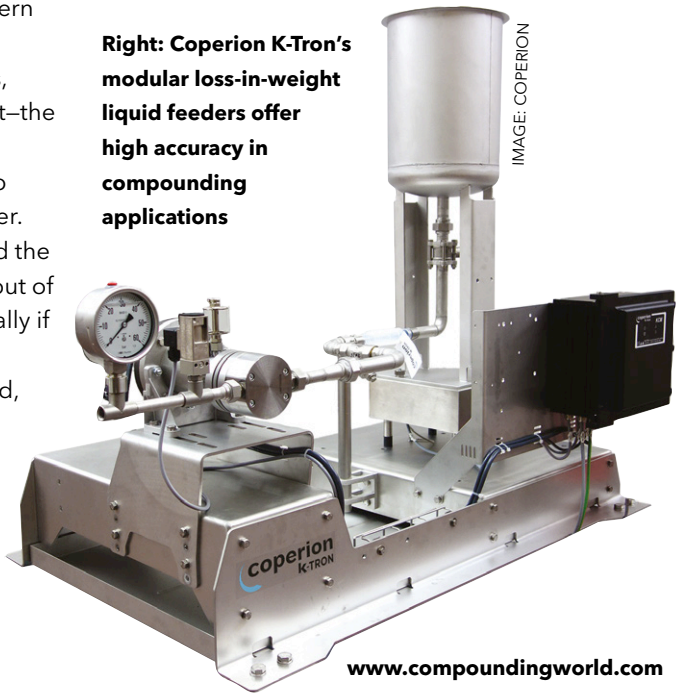

IMAGE: COPERION

Right: Coperion K-Tron's modular loss-in-weight liquid feeders offer high accuracy in compounding applications

new modular design of the Coperion K-Tron Loss-in-Weight Liquid Feeders, a broad range of pumps and tanks can easily be combined to constitute a reliable liquid feeding system representing the ideal configuration for the specific application," says Melton. "Although each liquid feeder is custom-designed to meet the desired feed rate, process demands and characteristics of the liquid, the new modular concept streamlines the layout and engineering process of a feeder—reducing its lead time and initial cost. The new modularity also provides benefits in terms of a uniform mechanical construction as well, with identical operation and maintenance for multiple differently-sized units. This simplifies feeder operation, maintenance and spares inventory, which in turn saves effort and cost. The same applies for retrofits."

Coperion K-Tron claims that its modular liquid feeders are suitable for accurate gravimetric feeding of liquids in either continuous or batch operation. The liquid is metered by a pump outside of the scale area. This feed pump is selected according to the feeding capacity required and the characteristics of the liquid to be fed.

Custom solutions

The modular concept makes it easy to tailor each liquid feeder to the parameters of the customer's process. The foundation of the modular feeder is a base frame, available in various lengths and widths, which can be fitted with optional feet or casters. The pump and weighbridge are mounted on the base frame, with pump technology selected depending on the viscosity of the liquid (for example, a gear or membrane pump).

The Smart Force Transducer (SFT) weighing technology employs vibrating wire technology and an on-board microprocessor with special control algorithms to ensure high feeder accuracy. The storage tank is mounted on the scale. Standard sizes range from 7.5-300 litres, but larger customised systems have also been realised. A flexible connecting line is required between the tank and pump. Depending on the needs of the application, additional options such as insulation or heating systems to maintain the process temperature can be supplied. ATEX configurations are also available.

Melton says the company has been involved in a number of interesting recent compounding applications involving liquid feeders. "In many

A loss-in-weight liquid feeder from Coperion K-Tron with insulated heating to keep viscous liquids flowing

IMAGE: COPERION

compounding processes the liquid component is introduced downstream under melt pressure to avoid early degradation of antistatic properties, for example," says Melton. "Working with an international customer in the UK, we developed several special configurations to handle low pressure addition to an atmospheric port in the case of crosslinking promoters/catalysts in sheet foam manufacture. The addition rate is critical, hence the need for accurate gravimetric feeding and the nature of these fluids means that the pump selection is critical, requiring extensive trials to ensure long life.

"We discovered progressive cavity positive displacement (PD) pumps with stainless rotors and fluoropolymer elastomer or EPDM stators worked extremely well, with a linear flow rate, but only for a short time because the elastomer absorbed the fluid and became deformed. Switching to conventional gear pumps with a loading valve worked well until the shaft seals failed due to rubber ingress," he says. "The final solution, which is now in production use on many foam lines, uses our SFT weighing technology coupled with magnetically driven gear pumps, sealed from all mechanical forces."

Coperion says that ,in addition to its focus on further improvement in core weighing and control technology, it plans to intensify its cooperation with leading pump manufacturers to enable it to provide optimised packages for specific liquid feeding compounding applications.

Dosing flexibility

One of the benefits of using liquid colourant and additives in compounding is the flexibility of dosing location, according to **Riverdale Global**. "Due to the flowable nature of liquid products, one has the ability to pump the material to several different possible entry points," says Sales Manager Luke Irish. "You can dose into a blender if any premixing is necessary; you can dose directly into the throat through an adapter tube that can bring your dosing

within 0.5 inches [1.27cm] of the screw; or you even have the ability to dose downline on the barrel of the extruder either through a vent hole or a manually drilled hole depending on desired location."

Irish says compounders can also benefit from faster incorporation. "Liquid colour and additives begin to disperse as soon as they are introduced to the material in the process, whereas other forms of colourant and additives rely heavily on heat and shear pressure to disperse fully. This can lead to better dispersion in the finished part when using liquid and also lends itself to the possibility of dosing further down the barrel for faster colour changes. However, finding the dosing location that gives you the best combination of strength and dispersion along with shortest changeover and cleanout times is key," he says.

Riverdale Global says that using its Gravimetric System (RGS) and Pump In A Drum (PIAD) technology, dosing is simple. Only electrical power and an air supply is needed to run the RGS dosing units. No calibration is required—the operator simply enters the let-down ratio of the liquid material, the throughput of the extruder (in lbs/h or kg/h), and the density of the liquid material (which can be found on the label of the pail/drum). The RGS also has the ability to run in continuous or extrusion-following mode (where dosing is determined by the speed of the screw).

The company says that optimal applications for liquids include production of pre-coloured compounds and incorporation of highly concentrated additives at low let-down ratios.

Compounders handling recycled feedstocks may also benefit from the company's +Restore liquid additive, which is claimed to restore physical properties when using post-consumer recyclate (PCR) or regrind. Riverdale says it has been shown to improve the physical properties of regrind to within 99% of virgin. It also ensures better flowing resin that is easier to process and has been shown to increase part consistency in injection moulded applications.

Irish says the company is supplying a number of compounders that report the use of liquid colour technology allows them to make faster adjustments on-the-fly, and results in less build-up on the screw and easier management of raw materials. "They are also cleaner, safer and easier to use than straight powder pigments," he says.

IMAGE: RIVERDALE GLOBAL

Left: Riverdale Global's RGS gravimetric system offers simple calibration-free set-up

IMAGE: SHUTTERSTOCK

Above: Custom compound production is a prime potential application for liquid colorants

Modular package

Materials handling specialist **Movacolor** also offers a liquid dosing option. MCLiquid is a modular liquid dosing system that includes one universal motor unit, a choice of pump types (all available in volumetric and gravimetric versions) and several spill-free packaging concepts.

The peristaltic pump is said to provide a fast and easy colour change solution. Peristaltic pump output is heavily dependent on the viscosity of the liquid being processed, as well as the type and quality of the output hoses. The company says this is effectively compensated for in the gravimetric pump option.

Movacolor can also offer a gear pump alternative, which is also available as a gravimetric and volumetric dosing system and offers long life, pressure up to 10 bar, viscosity-independent output, and very good performance at low dosing rates. A Mono progressing cavity pump is recommended for high dosing rates. In-line mixers and special nozzle adapters for easy installation and cleaning can be supplied.

The MCLiquid system is said to be reliable and traceable. The gravimetric technology eliminates pre-calibration and gives 100% control of dosed quantities, 24 hours a day, according to the company. The gravimetric MCLiquid can also be integrated with the company's gravimetric solid dosing or MCContinuous Blender system.

CLICK ON THE LINKS FOR MORE INFORMATION:

- **www.brabender-technologie.com**
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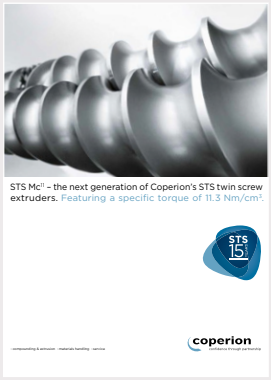

Coperion's STS Mc11 line of twin screw extruders provides performance at a competitive price. This brochure describes the full features of the range, from the newly launched 80 kg/h 25mm diameter laboratory model to the 4,200 kg/h 96mm version.

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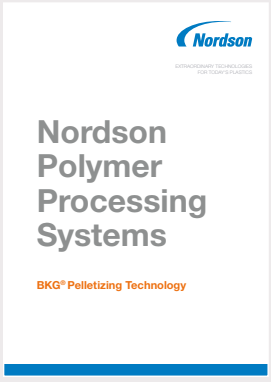

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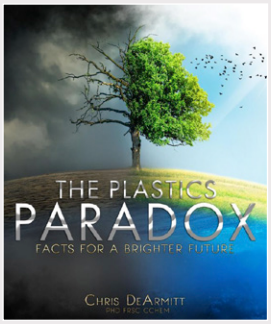

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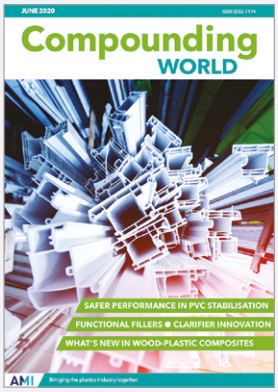

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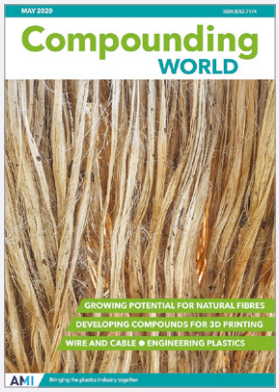

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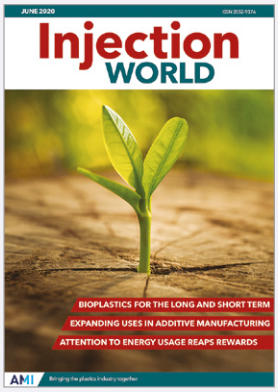

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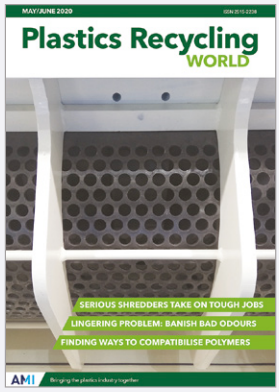

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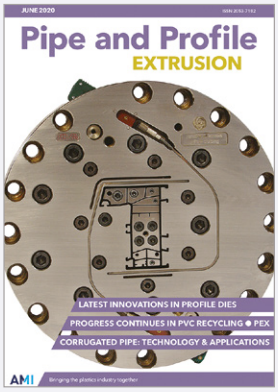

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	21-25 September	Colombiaplast, Bogota, Colombia **POSTPONED**	www.colombiaplast.org
	29 Sep-1 Oct	Interplas, Birmingham, UK **POSTPONED**	www.interplasuk.com
	6-9 October	Plastpol, Kielce, Poland	www.targikielce.pl
	6-10 October	IPF Japan, Tokyo, Japan **CANCELLED**	www.ipfjapan.jp
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	4-5 November	Compounding World Expo USA, Cleveland, OH, USA	www.compoundingworldexpo.com/na/
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	11-14 January	Plastimagen, Mexico City **NEW DATE**	www.plastimagen.com.mx
	13-16 April	Chinaplas 2021, Shenzhen, China	www.chinaplasonline.com
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