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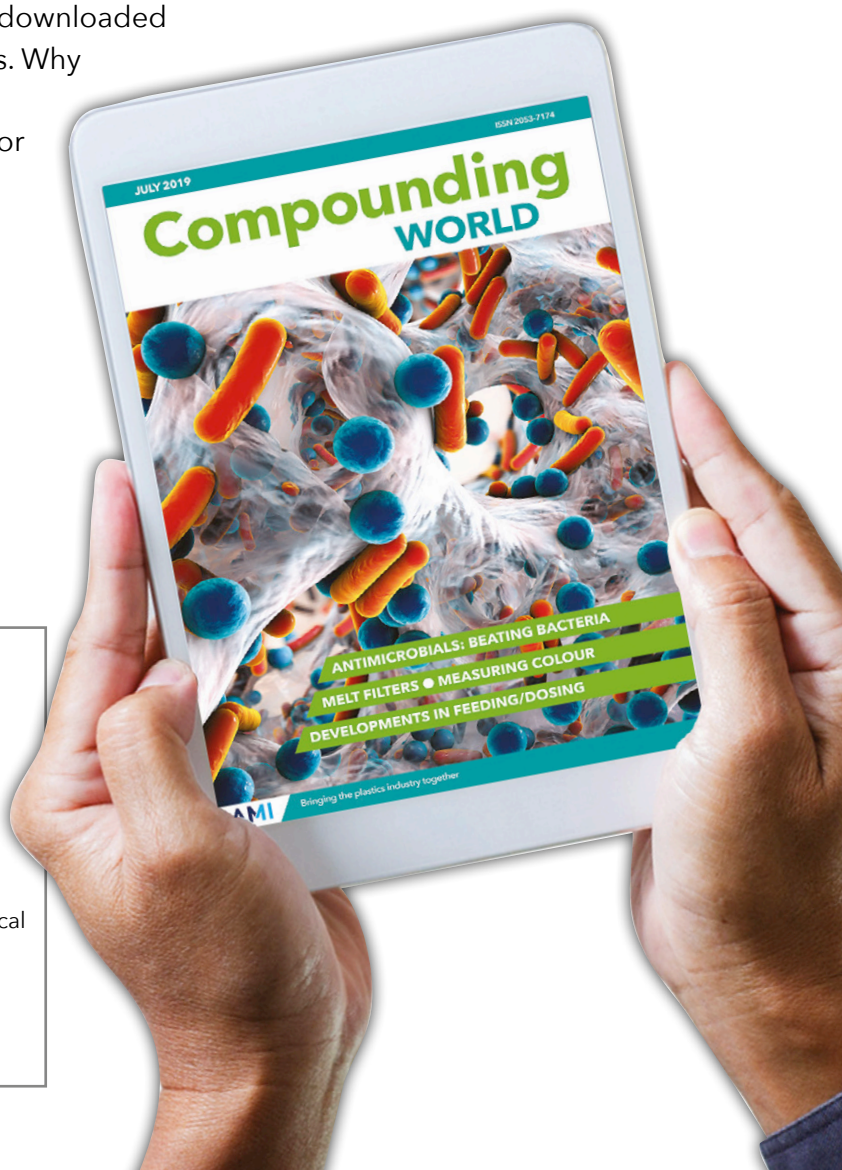

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Compounding WORLD

Sinochem to produce Elix grades in China

Sinochem is to build a new compounding plant at Yangzhou (Yisheng) Chemical Industrial Park, initially to produce grades developed by Elix Polymers, the Spanish ABS specialist it acquired in January 2019.

Part of Sinochem's Lightweight Materials business unit, the new plant is expected to start production by the end of 2021 with a capacity of 24,000 tonnes/year, rising to 56,000 in a second planned phase. Early products will include a number of ABS grades as well as ABS-PC and PC-ABS blends. PA, PP, PBT, POM and other polymers will follow.


IMAGE: SINOCHEM

Sinochem's new compounding plant at Yangzhou in China

A sales team has already been established in China to handle the Elix product portfolio and is said to be working on a number of projects based on the firm's speciality products.

› **www.sinochem.com**
› **www.elix-polymers.com**

Rowa Masterbatch ups capacity

Rowa Masterbatch is investing at its production site at Pinneberg, Germany. The company has acquired a Coperion ZSK 32 compounding extruder to replace an older machine and taken over a production and mixing area formerly used by partner Tramaco to add a further 500m² of space.

Rowa said in a statement that this "marks the next phase of the comprehensive modernisation and reorganisation of the factory environment."

The ZSK 32 is described as ideally suited to Rowa's needs, facilitating an easy scale-up from small to large batches and being able to handle all of its product lines.

In the first phase of the expansion project, the company is expanding the mixing area and will add a new Mixaco mixer. It will also improve material flows and dust management. The next phase in 2021 will prepare the facility to take three additional extruders.

› **www.rowa-masterbatch.de**

Coated fibres for EMI apps

German start-up FibreCoat, a spin-off from the RWTH institute at Aachen University, has introduced Alucoat, a line of aluminium-coated glass and basalt fibres intended to provide EMI shielding in equipment such as sensors and mobile communications.

The fibres are available as yarns and woven or non-woven fabrics. They are said to provide shielding across a broad frequency range with an effectiveness of 80-120dB. The fibres also offer high electrical and thermal conductivity.

FibreCoat CEO Dr Robert Brüll said Alucoat is the first fibre on the market where each filament is coated uniformly during spinning. "Therefore, the product has superior properties. It outperforms in shielding and thermal conductivity and has a significantly lower price than any of today's incumbent products," he said.

› **www.fibrecoat.de**

Ineos takes control of Gemini HDPE in US

Ineos Olefins & Polymers (O&P) USA has acquired Sasol Chemicals North America's 50% stake in Gemini HDPE for $404 million. The move gives Ineos 100% control of the operation.

Gemini is a toll manufacturer of bimodal HDPE products that are supplied to the pipe and film markets from its production site at La Porte in Texas. Acquiring it, said Michael Nagle, CEO of Ineos O&P USA, "would allow our business to meet increased demand from our customers".

› **www.ineos.com**

TITK opens €1.5m tech centre

The Thuringian Institute for Textile & Plastics Research Rudolstadt (TITK) in Germany has officially opened its new €1.5 million technical centre, which is equipped with three Leistritz twin-screw extruders.

The extruders will be used in several projects, including development of isocyanate-free polyurethanes, special medical polymers, and biodegradable adhesives and foams.

The extruders incorporate a number of special features. One is configured with a melt recirculation facility, allowing the time the material spends in the processing section to be controlled. Another is equipped to allow gases to be introduced directly into the melt.

The most powerful of the three machines is configured with an extended process section for reactive processing work and is equipped with Leistritz's in-line rheometer. "This allows us to produce high-performance plastics that are used in medical technology as implants or as high-strength surgical nails, among other things," says Reinemann.

IMAGE: LEISTRITZ

Left: TITK and Leistritz officials at the opening of the new €1.5m centre

› **www.titk.de**
› **www.extruders.leistritz.com**

Celanese goes bio for POM

Celanese has launched Hostaform POM Eco-B, a POM resin produced from renewable feedstocks and aimed at the growing demand for such materials from the automotive, consumer and medical device industries.

POM Eco-B grades are certified as containing up to 97% bio-content within the International Sustainability & Carbon Certification (ISCC) Plus system using a mass-balance approach. It reduces CO_2 content per kilogram of polymer by up to 1.15 (more than half).

The introduction follows the launch last month of the company's BlueRidge cellulosic pellets, which are based on cellulose acetate.

› **www.celanese.com**

Foster and Aran Biomedical work on implantable PP

Foster Corporation of the US, which compounds plastics for medical devices and general pharmaceutical applications, has partnered with Aran Biomedical of Galway, Ireland, which specialises in biomaterial products for implantable medical devices.

Foster currently provides cleanroom compounding services to companies that require functionality compounded into permanently implantable materials such as bioresorbable polymers, PEEK and polysulphones. It will now add Aran's ProTEX Med grade of PP to its offering.

The two companies plan to work together to market ProTEX Med, which is offered as a custom synthesised, permanently implantable PP backed by FDA Master File reference data and certified to ISO 10993-5.

› **www.fosterpolymers.com**
› **www.aranbiomedical.com**

Maag supplies DSM

As part of the ongoing modernisation and expansion of its compounding plant at Evansville, Indiana, US, DSM has installed an unsdisclosed number of Jet Stream Granulation (JSG) strand pelletising lines from Maag Group.

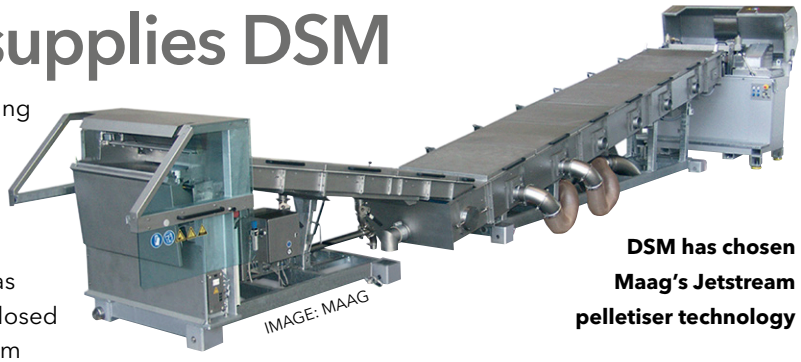

IMAGE: MAAG

DSM has chosen Maag's Jetstream pelletiser technology

JSG systems are fully automated from the die head, with any strand breaks being immediately fed back into the pelletiser during production. According to the company, this makes them "particularly popular for the pelletising of highly filled compounding products."

› **www.maag.com**

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IN BRIEF...

The Covid-19 pandemic continues to impact on the global trade show calendar. **Messe Dusseldorf** has announced the cancellation of the Russian **Interplastica 2021** fair, which was due to take place in Moscow in January. It will now take place on 25-28 January 2022. The organiser has also announced the cancellation of the **Interpack 2021** packaging show, due to take place in Dusseldorf from 25 February to 3 March next year. It will next take place in 2023.

www.interplastica.de
www.interpack.com

Ascend Performance Materials has added a number of new grades to its HiDura range of long chain PAs. The PA 610 and PA612 products offer very good dimensional stability along with high resistance to chemicals, impact and abrasion. Target applications include engineering components and cable ties.

www.ascendmaterials.com

German mixer firm MTI calls in administrators

German mixing machinery MTI Mischtechnik International has initiated insolvency proceedings. The company, based at Detmold, continues to operate while new investment is sought for the business.

"Our clear objective is to maintain the business operations of MTI", said the court appointed insolvency administrator Hans-Achim Ernst. "We are certain that we can offer attractive starting points for a strategic buyer due to the high profile of the company and its access to various customer industries."

Corporate auditing company Mentor has been commissioned to implement an investor search. "Our focus in the search for investors is clearly on strategic investors from the field of process technology," said Uwe Borgers at Mentor. "In our opinion, MTI is very well suited to complement a large, internationally active machine and plant manufacturer."

Compounding World understands that discussions are underway with interested parties with the aim of securing a deal before the end of the year.

MTI produces bulk mixing machinery and plant for a wide range of industries, including masterbatch, compounding and PVC processing. Over the past 40 years it has supplied more than 2,000 mixing projects. The company employs some 50 people and generates annual sales of around €7m.

› **www.mentor.ag**
› **www.mti-mixer.de**

Sitraplas extends lab options

German technical compound producer Sitraplas has extended the capabilities of its technical centre at Bünde with the installation of a Maag Automatik STB250 conveyor strand pelletiser.

The centre, which the company uses for development of its own products and rents out to customers for process or formulation deveopment is equipped with two 26mm Coperion ZSK extruders as well as a single screw extruder, which is used for filament production.

The company said the new pelletiser supplements the centre's existing wet-cut pelletisers and will enable it to handle moisture sensitive and highly-filled and brittle compounds.

› **www.sitraplas.com**

Holland Colours aids Ocean Cleanup

Holland Colours supplied colour masterbatch based on bio-based carrier resins for a range of sunglasses made using plastics recovered from the Great Pacific Garbage Patch for The Ocean Cleanup project.

The sunglasses are said to be the first product made with certified ocean plastic from the Great Pacific Garbage Patch. The Ocean Cleanup, which is a non-profit organisation that develops advanced technologies to remove plastic waste from the seas, will use the proceeds from their sale to fund its activities.

Holland Colours worked with The Ocean Cleanup team over several months to create two different shades of blue that could be dosed simultaneously to create a swirl pattern that mimicked the ocean, according to the company's Global Marketing Director Gina Provó Kluit.

› **www.hollandcolours.com**
› **www.theoceancleanup.com**

Holland Colours developed a custom two-shade masterbatch for Ocean Cleanup

IMAGE: HOLLAND COLOURS

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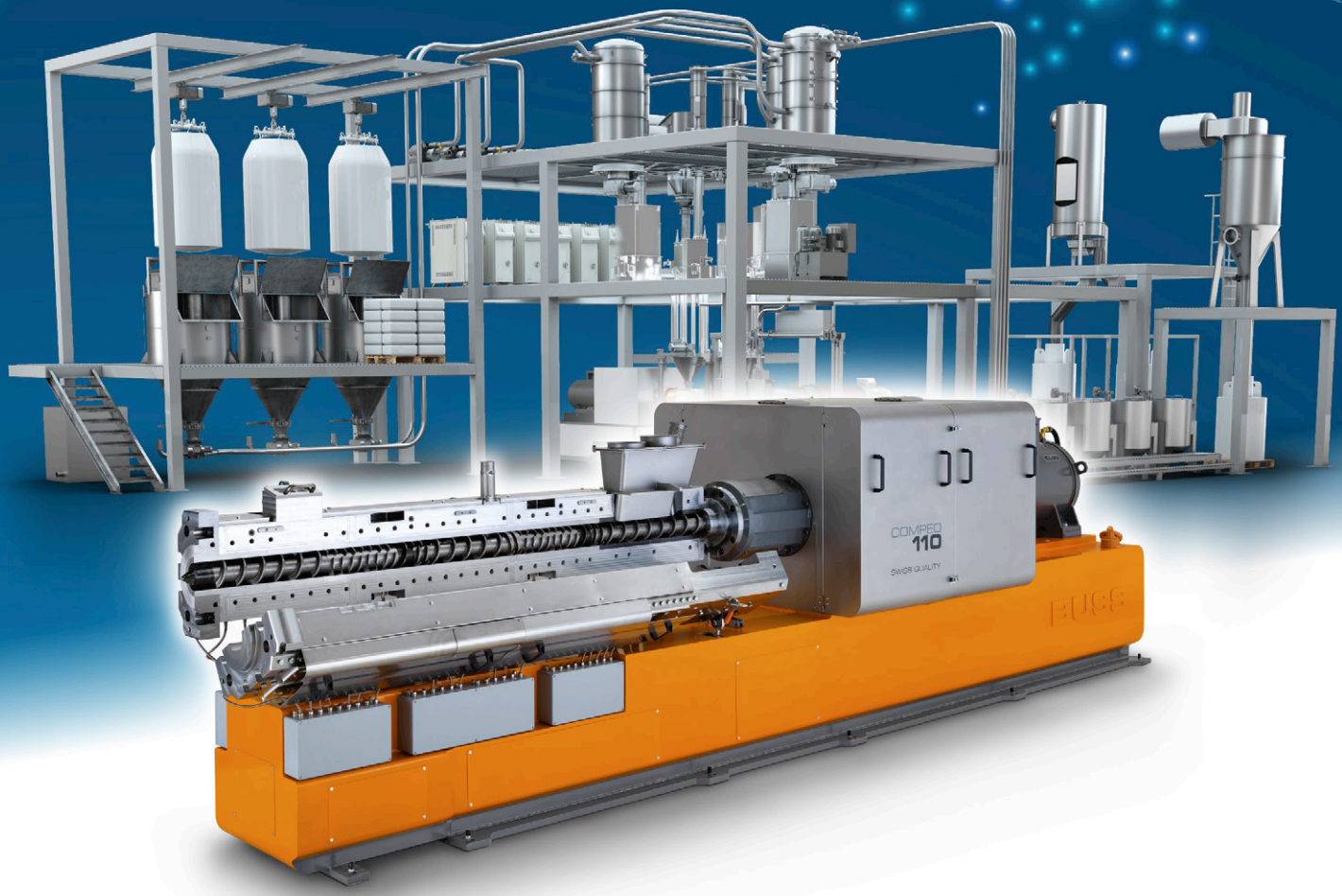

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Matrix Plastics sets up standalone medical compounds division

UK-based Matrix Plastics, which produces colour compounds and masterbatches, has established a standalone medical unit. Matrix Medical Plastics will operate from a newly-built production unit alongside the company's main location in Slough.

The company already has a presence in the UK medical sector, supplying to producers of oxygen masks, tubing and surgical equipment. Formation of the new business unit and dedicated clean production area recognises the increasing quality and regulatory demands placed by customers on suppliers in the sector.

"We've been working with medical customers for a long time but it's becoming more and more evident that the stringent quality and process control demands of the medical sector need to be met with even higher quality standards when it comes to material processing and manufacturing," said Matrix Plastics Managing Director Nigel Batt."Following significant investment, we now pride ourselves on being the UK's first 'clean-room' medical plastic compounding facility with a sterile manufacturing environment and impeccable hygiene standards," he said.

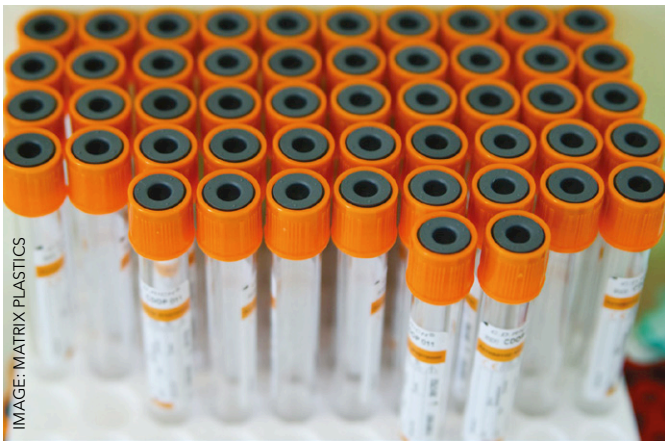

IMAGE: MATRIX PLASTICS

Matrix is investing in its medical capabilities

The new unit, which is equipped with a Leistritz compounding line and laboratory for microbiological and chemical testing, is certified to ISO Class 9 cleanroom and ISO 13485 quality management systems. All ingredients used on site meet the requirements of ISO 10993-1:2018 and USP Class VI and all compounds are manufactured to WHO and FDA Good Manufacturing Practices.

› **www.matrix-plastics.co.uk**

RTP buys no-scratch patents

Global compounder RTP Company acquired TenasiTech's anti-scratch additive patents in September and said it will launch a new portfolio of materials using the technology in 2021.

According to Scott Koberna, General Manager - Wear and Friction at US-headquartered RTP, the nanoparticle technology "greatly improves scratch and mar resistance in injection moulded thermoplastics".

The company will initially integrate the technology into PA, POM and polyester resin systems. "We will offer clear grades, and can achieve many colours, including the coveted 'Piano Black' hue," he said.

Longer term, Koberna said the company will explore use in other polymers, solvent- and water-based coatings, and sheet and film extrusion.

› **www.rtpcompany.com**

Logitech to boost PCR polymer use

Computer peripherals company Logitech has committed to incorporating post-consumer recycled plastic (PCR) in more than 50% of the computer mice and keyboards in its Creativity & Productivity portfolio by the end of 2021, reducing virgin plastic consumption by around 7,100 tonnes/yr.

The company first began using PCR three years ago, with most recent introduction its Ergo M575 mouse (pictured), which the company says "started with a design goal of maximising the use of PCR plastic in the black, graphite and off-white model".

The company said it will alo provide full transparency on the PCR content in each product, starting with the Ergo M575. It will vary between 20% and 80%, depending on type, colour and material make-up.

› **www.logitech.com**

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IN BRIEF...

Russia's **R&P Polyplastic** said that its Arnamid electrically conductive PA6, which contains single wall nanotubes produced by **OcSiAl**, is being used in production of electrostatically-painted exterior trim parts for the Group Gaz Gazelle NN light commercial vehicle.
www.polyplastic-compounds.ru
www.ocsial.com

KD Feddersen group company **AF-Color**, a division of Akro Plastic, has developed a new line of carbon black-free NIR-detectable colour masterbatches to simplify automated recycling sorting. The company says it can offer a formulation for almost any colour requirement.
www.af-color.com

US-based PET bottle recycler **CarbonLITE** has developed and launched a pelletised compound produced from caps and labels from the items it recycles. It is targeting the new offering, which it describes as a fully homogenised blend of PE and PP called CaPOLabel, at injection moulders.
www.carbonliterecycling.com

3D printing firm **MakerBot** has added a PA 12 carbon fibre to its material portfolio. The material, which it began shipping in November, can be printed on the company's Method and Method X 3D printers using the MakerBot Composite Extruder.
www.makerbot.com/method

Avient executives tout its global capabilities

The additive and colour masterbatch market reach of Avient – formed in July through PolyOne's acquisition of Clariant's masterbatch business – was outlined by executives last month.

Avient is expecting sales of just under $4bn in 2020. The group has 105 locations in about 30 countries, compared with about 60 locations in 20 countries for PolyOne before the deal. It has more than 16,000 customers. "We believe the acquisition has been a multiplier," said Jennifer Prugh, VP Corporate Marketing at Avient.

The former Clariant masterbatch business operated in similar end markets to the Polyone business. Woon-Keat Moh, President, Color Additives Inks, Americas and Asia, said the two companies had similar and complementary technologies and are aligned in their market trend areas, for example in the move to increased use of recyclate.

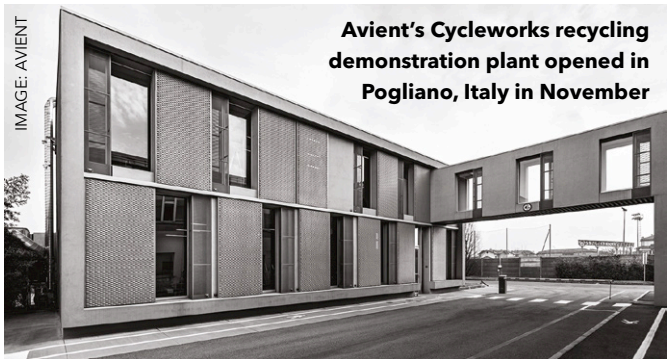
IMAGE: AVIENT

Avient's Cycleworks recycling demonstration plant opened in Pogliano, Italy in November

In the Color Additives Inks business, which accounts for half of Avient's group sales, fewer than 10% of the combined customer base is formed of shared customers, which is "less overlap than we anticipated", said Michael Garratt, President, Color Additives Inks, EMEA. It has emerged there is also a more even split in sales on a regional basis. He said Europe accounts for 39% of Avient sales, US and Canada 32%, Asia 23% and Latin America 6%.

Garratt said revenues from what the company defines as sustainable solutions is expected to rise from $410m in 2019 to $550m in 2020, with compound annual growth of 8-12% targeted for the next few years. New products in this area include Colormatrix Aazure, a process aid for PET that can reduce acetaldehyde by up to 80% to allow higher levels of rPET to be used, and Oncolor Naturals, which are made with natural pigments for use with bio-sourced and recycled polymers.

Avient also opened its Cycleworks Innovation Center, a recycling demonstration plant, in Pogliano, Italy, last month.
› **www.avient.com**

BASF aims for radar clarity


IMAGE: BASF

New Ultradur RX grades are formulated for automotive radar housings

BASF has developed a new grade of PBT – Ultradur RX – developed specifically for radar sensor housings in vehicles.

Ultradur RX is said to meet the requirements for sensor housings for automated driving by absorbing and reducing signal noise while being lighter than metal alternatives.

The compound also shields the sensitive electronics from electromagnetic waves emitted from other vehicles. Different grades are designed to absorb and reduce interference radiation in the 76-81 GHz range.
› **www.plastics.basf.com**

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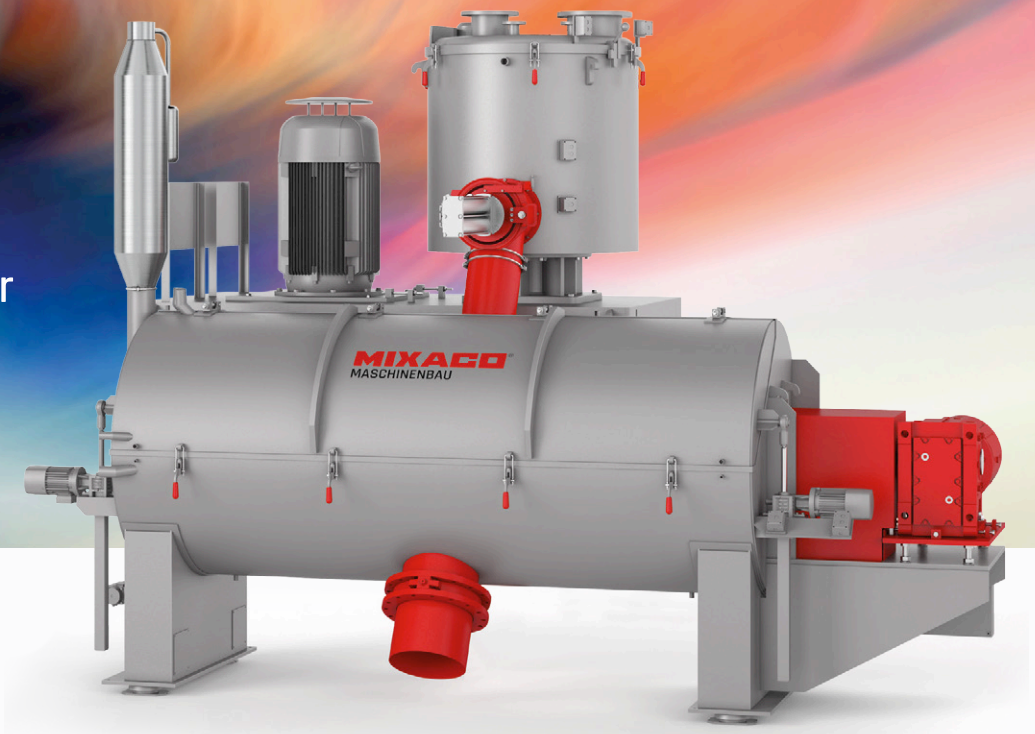







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Benvic steps into polyolefins

PVC compounder Benvic has expanded its reach into polyolefin-based compounds with the introduction in Europe of Benvic Linkflex HF, a range of materials aimed at halogen-free and low smoke applications in the cable sector.

The company says the Linkflex HF grades have been optimised for cost-effective cable manufacturing, primarily by reducing the amounts of material required while improving processing stability.

The current range is targeted at low voltage applications in buildings and datacoms but the company said it plans to extend this to include industrial, utilities and heavy duty applications. Different grades are available that meet typical industry standards, including the new Construction Product Regulations currently being implemented in the EU.

› **www.benvicforcables.com**

MAIP and Eastman to launch eco-projects

Italian compounder Gruppo Maip has teamed up with Eastman to develop a line of sustainable polymer compounds for use in automotive interior applications based on Eastman's Tritan Renew and Treva Renew materials.

Tritan Renew is a copolyester with a 50% certified recycled content; Treva Renew engineering polymers, which are intended as alternatives to ABS, PC and PC-ABS blends, offers up to 48% bio-based content and up to 23% recycled content (both based on USCC mass balance).

"This partnership allows us to develop breakthrough specialty plastic formulations for automakers to meet their aggressive targets for sustainable content and replacement of petroleum-based materials," said Eligio Martini, President of Gruppo Maip."OEM manufacturers will now be able to specify content and recycled-content plastics in critical Class A components."

› **www.maipsrl.com**

› **www.eastman.com**

Vynova goes circular in PVC

European PVC producer Vynova has launched what is claimed to be the world's first range of circular-attributed PVC resins. The VynoEcoSolutions branded products are certified under the International Sustainability & Carbon Certification (ISCC) Plus framework according to a mass balance approach.

The resins will be made at the company's sites at Beek in the Netherlands and Mazingarbe in France using Trucircle ethylene feedstock supplied by SABIC from its site at Geleen in the Netherlands. The ethylene is produced from pyrolysis oil chemically recycled from plastic waste and is said to cut CO_2 emissions by 50%.

IMAGE: VYNOVA

Vynova's site at Beek will produce its ISCC-certified circular PVC

According to Vynova, the circular resins meet the same product quality and material performance as its conventional PVC grades. Converters will be able to process them on existing equipment in both rigid and flexible applications.

› **www.vynova-group.com**

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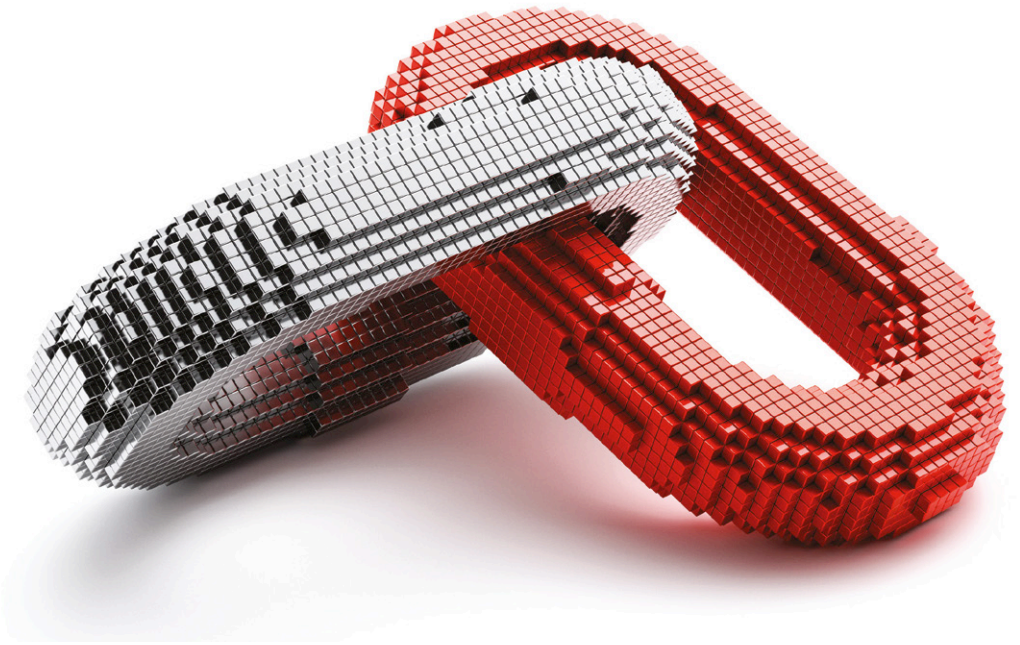

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IMAGE: SHUTTERSTOCK

Regulation drives FR development

The safety benefit of flame retardants is clear but tighter health and environmental regulation is pushing development in the direction of more sustainable solutions. Peter Mapleston reports

Regulation and consumer preference are proving the key drivers behind development of new flame-retardant systems for use in thermoplastics. Suppliers of an increasingly diverse variety of halogen-free flame retardants (HFFRs), which are increasingly seen as more sustainable than halogenated types, are making considerable progress in addressing performance issues relating to some of their products. Meanwhile, producers of traditional and long-established brominated systems (BFRs) are presenting arguments to challenge what they see as unfair new laws restricting their use.

On the halogen-free side, industry association **PINFA** (Phosphorus, Inorganic & Nitrogen Flame Retardants Association) says it sees interest in HFFRs continuing to grow. "Strong opportunities, or indeed obligations, for PIN FRs will result in coming years from the EU's Green Deal," it says. "The Green Deal is already leading to new policy initiatives such as the new Chemicals Strategy with its 'Zero Pollution Ambition,' and the Sustainable Products Initiative. Further policy developments are expected soon, including a revision of RoHS (Restriction of Hazardous Substances), which already bans several brominated FRs in E&E applications."

HFFR take-up is also expected to benefit from EU moves towards circularisation and ecological design. "The new Circular Economy Action Plan specifically targets recycling in electronics and IT, batteries and vehicles, plastics and textiles so that plastics additives must aim to be safe for end-of-life recycling," according to PINFA. "The EcoDesign Directive [will exclude] halogenated FRs in enclosures and stands of screens and displays. Proposals are being considered to widen the scope of the Directive, which currently covers only certain electrical products."

The new EU policy context will pose challenges to the chemicals industry and to compounders and plastics users. But PINFA believes it will also bring opportunity for innovation, pointing out that nearly all R&D in the area of flame retardancy is today targeting PIN FRs. "The trend towards environmentally preferable PIN FRs will be accelerated," it says. "At the same time, existing PIN FRs, known to be safe and effective, will continue to be improved.

Main image: Tightening regulation, particularly in Europe, is challenging flame retardant producers to meet increasingly demanding environmental and performance goals

New formulations, co-polymers or oligomer forms, combination packages of PIN FRs or use of specific PIN synergists, will ensure that PIN FRs respond to demanding user specifications."

It should be said that PINFA's perspective contrasts with that of **BSEF** (the International Bromine Council) whose members include leading suppliers of brominated flame retardants. BSEF has lodged formal proceedings with the European Court of Justice in Luxembourg against the EC with respect to the new regulation on electronic displays. Keven Bradley, Secretary General of the BSEF, says it disagrees with the regulation's "unprecedented and unwarranted restriction." See the article on page 35 for more information on this.

Automotive drivers

PIN FR additives producer **Adeka** sees automotive safety concerns driving interest forward. "Increasing safety awareness is driving expanded use of flame retarded materials," the company says. "In automobiles, flame retarded materials have until recently only been used for interiors. For the next generation of automobiles, however, flame retarded materials are expected to be used for the entire propulsion system, including the various parts of battery construction in an EV. Less obvious but just as crucial, flame retarded materials are expected to be used for high voltage equipment including charging stations and electronic instruments for control and operation."

Flame retarded PC and PC alloys are being considered for charging station housings for EVs, Adeka says. "Currently retardancy performance requires a UL94 V-0 classification at 1.6mm. The trend however is toward V-0 at 0.8 and even 0.4mm."

Bisphenol-A bis(diphenyl phosphate), otherwise known as BDP and which Adeka supplies as ADK Stab FP-600, and resorcinol bis(diphenyl phosphate, or RDP, are both commonly used as flame retardants for PC and PC alloys. But Adeka says they have some limitations. "In order to meet the flame retardancy requirements at lower thickness, higher loadings of the flame retardant will be required. The decrease of heat deflection temperature (HDT) accompanying this makes the flame retarded material unsuitable for certain applications."

IMAGE: SHUTTERSTOCK

Above: FRX Polymers' Nofia can provide flame retardance in PC alloys without compromising car makers' preferred piano black finish

To solve this problem, Adeka has developed a new liquid phosphate ester flame retardant – ADK Stab FP-900L – that it says combines higher flame retardancy and an improvement of HDT compared to market reference phosphate ester FR. The improved HDT comes from the combination of the reduced plasticising effect of the additive due to its more rigid oligomeric structure as well as the lower dosage levels required, the company says.

In tests with a PC reinforced with 10% glass, ADK Stab FP-900L dosed at 20% provided a V-0 classification at 0.8mm, whereas BDP could only achieve V-2. In a 30% reinforced sample, the same result was achieved at an FP-900L addition level of 15%. In both formulations, HDT was around 5°C higher for the compound based on the new flame retardant.

Flame retardants for PC, as well as other thermoplastic polyesters, are available from **FRX Polymers**. At last year's K2019 trade show, the company introduced developments with its Nofia polymeric and reactive phosphonate products in applications for recycled PET (rPET) and in PET/PC and PBT/PC blends for medical applications. Updating on progress this October, Sales & Marketing VP Ina Jiang said PC/PBT blends have been receiving OEM approvals in medical and also automobile interior applications. She says that some customers have also carried out trials with PC/ABS and PC/ASA blends, which have "an excellent overall balance of properties and exceptional processing." In these blends, it has been possible to obtain V-0 ratings down to 0.75mm. "This is outstanding for a

IMAGE: PINFA/SHUTTERSTOCK

Left: Car makers are facing flame retardant selection challenges, including compliance with new EV standards and regulations, calls for improved sustainability, and the need to avoid corrosion of electronic and electrical systems

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1	100	0	0	V2	89	12
2	99.85	0.15	0	V2	88	17
2	99.85	0.15	1	V0	88	14

Table 1: Momentive's SFR320 flame retardant can deliver a UL94 V-0 rating in polycarbonate at 1% concentration while maintaining transparency and low temperature impact properties. Momentive says the phenyl substituted low viscosity silicone fluid (previously marketed as Y-1932) is compatible with many polymers and can provide improved processability, flame propagation inhibition and combustion rate
Source: Momentive

PC alloy," says Jiang. "Most PC alloys obtain V-0 at no thinner than 1.5-1.6mm."

Jiang sees good potential for PC/PBT compounds containing Nofia in automotive interiors, since it is possible to obtain parts with the car industry's preferred high-gloss piano black finishes. She also notes the unwanted plasticising effect of BDP and RDP in PC alloys. "In a non-FR PC/ABS system, the HDT is around 120-130°C and BDP/RDP can reduce that to 85°C. The Nofia solution has no effect on the HDT. In PC/PBT, the HDT of a Nofia-based solution is 30°C higher than BDP/RDP solution."

Nofia has already shown advantages in PET fibre and rPET, but Jiang says PET films and foams are now also proving to be key applications. In BOPET film for example, she says Nofia is the only flame-retardant system that can yield the highest UL94 VTM (Vertical Thin Material) rating of VTM-0 in a fully transparent film down to 15 microns. Other halogen-free FR additives can cause haze. The Nofia flame retardant can be added directly into the film extruder or used in a masterbatch.

Developing potential

Other key applications for VTM-0 BOPET films include 5G components, EV batteries, numerous electronic devices, high-speed data transmission flat cables, and solar panels. The company says Nofia polymeric FRs can also function as master-batch carriers. As a lot of BOPET film requiring FR properties also needs to be black, the additive can be used as a carrier for carbon black, which Jiang says can result in a cost saving.

Claiming to be the world's largest supplier of sulphonate FR products for polycarbonates, **Arichem** says the technology is "uniquely suited to PC." It says its products are specific to the chemistry of how PC reacts to fire and are most often used at addition rates of less than 1%. The company says that its Arichem KSS-FR grade is already REACH registered and other Arichem FR products are in the process of registration.

"Arichem's FR products answer the call for halogen-free and are neither phosphorus nor metal hydrate based," says the company. "With the recent inclusion of potassium perfluorobutane sulphonate (and higher alkyl analogues) in the EU SVHC listing, reformulations with Arichem KSS-FR are taking place at an increasing pace across the FR PC compounding industry."

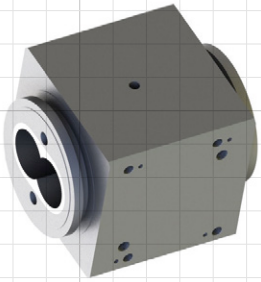
According to **Momentive**, customers in many industries using FR plastics are seeking alternatives to traditional halogenated flame retardants in response to a wave of new regulations in both Europe and the US that seek to address several related concerns covering environment, health, safety and recycling. "Given these trends, silicone-based solutions appear attractive from both a performance and low toxicity point of view. In terms of the former, the silicone-oxygen-bond offers certain distinct advantages over more traditional carbon-carbon-bond based approaches, most importantly when it comes to maintaining good mechanical properties and flame retardancy characteristics," the company says.

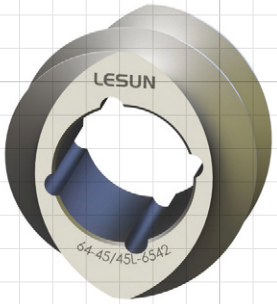
"The greater length of the Si-O bond enables greater permeability, the higher bond energy allows better stability, and the lower rotational barrier offers more flexibility. Combined, these differences lead to lower surface energies, better moisture, temperature and oxidation resistance, UV stability, biocompatibility and insulation properties," Momentive claims.

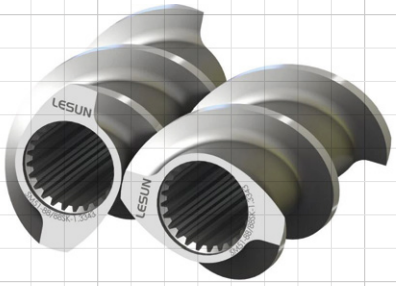
At **Techmer PM**, Product Development Manager Kaan Serpersu says the company is seeing increased demand in its key non-halogen and Oeko-Tex approved flame-retardant technology for the PET fibres market. "Traditional polymeric flame retardants for PET create numerous challenges in processing issues, mainly because of the low melting point of the flame retardant," he says. "Techmer PM's PTM112508 technology widens the process window allowing products to meet the most stringent specifications."

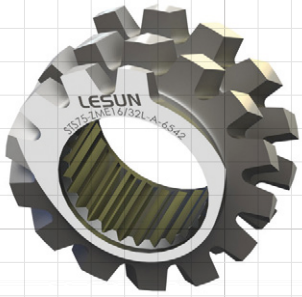
Serpersu says the technology, originally designed to meet the rigours of military apparel applications in accordance with ASTM D6413, can be designed for other specifications such as NFPA 701 and UL94. It is available in pellet form for easy implementation across various production processes.

Huber Engineered Materials says it has been advancing its FR business on several fronts. First off,









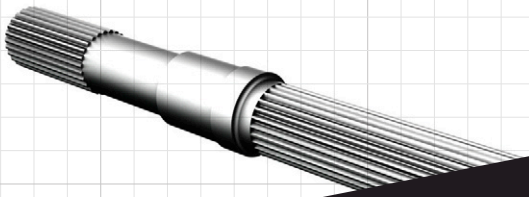


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IMAGE: SHUTTERSTOCK

Above: The cable industry is a key market for halogen-free flame retardant solutions, with increasingly demanding standards being imposed

it is in the process of introducing a new Safire nitrogen-phosphorus fire retardant technology. Secondly, it has also provided new data for its Kemgard smoke suppressants for use in flexible and rigid PVC. And thirdly, the company's Martinal OL-104 LEO precipitated ATH – originally developed in Germany by Huber Fire Retardant Additives business Martinswerk – has now been available in North America from the company's plant at Bauxite, South Arkansas.

Huber says Safire 400 melamine poly(zinc phosphate) "imparts an enhanced balance of flame retardancy, smoke suppression and char formation. It has been designed to catalyse the formation of a strong glassy char layer in most thermoplastics. In addition, the presence of zinc further reduces smoke production and helps suppress arc track values when required."

In recent studies, the company says Safire 400 has been shown to be a highly efficient synergist with aluminium hydroxide in LSZH (low smoke zero halogen) cable formulations. Partial replacement of AlOH reduces the rate of polymer decomposition via char formation. The protective layer of char provides a heat-insulation effect, reduces oxygen access, and prevents dripping of molten polymer. "Furthermore, the potential to reduce overall filler content will result in better physical properties of the jacketing compound," Huber says.

Kemgard smoke suppressants comprise molybdates precipitated on a functional core material to maximise the active surface area. Depending on the material, the core can offer secondary benefits such as additional fire retardancy or improved processability. The molybdate chemistry is designed to catalyse crosslinking in the PVC matrix, leading to improved organic char formation.

Cable demands

Germany's **Nabaltec** says that polyolefin compounds highly filled with aluminium hydroxide (ATH), which it sells as Apyral, or magnesium hydroxide (MDH) are widely used for sheathings of electrical and communication cables. However, for low fire hazard and fire-resistant cables more stringent requirements are imposed and these standards can be difficult to meet and frequently render the additional incorporation of flame-retardant synergists necessary, the company says.

Certain synergistic flame retardants (such as organically modified nanoclays) can negatively impact compound processability and aging performance, according to Nabaltec. To overcome this problem, it says it has developed a new flame-retardant booster – Actilox PA-B2 – that it says allows HFFRs to fulfil demanding flame retardancy standards while providing enhanced compound processability.

"Furthermore, Actilox PA-B2 leads to a reduced

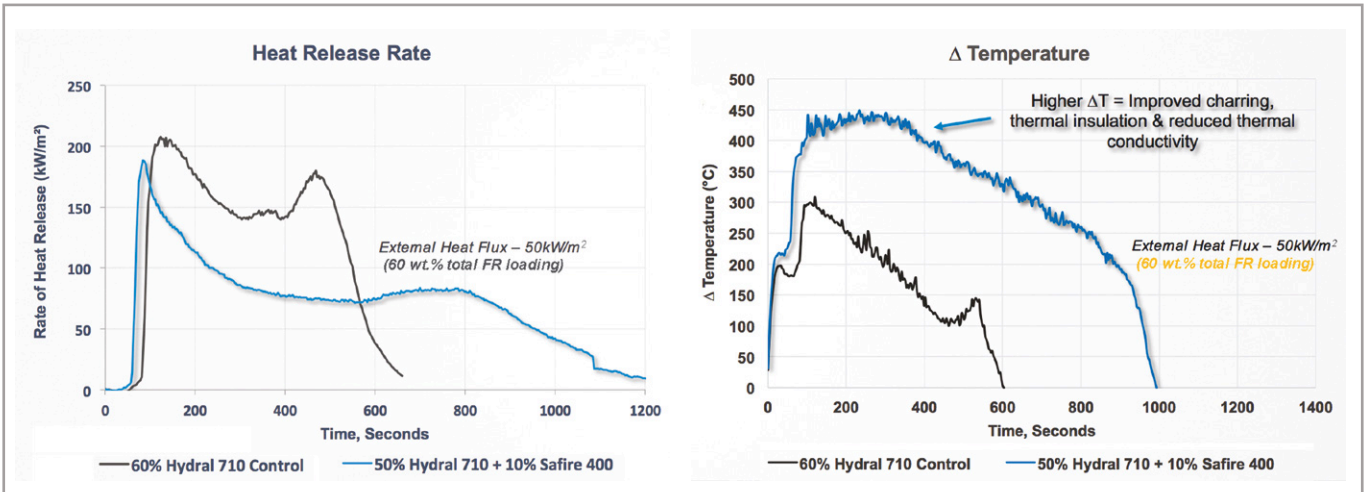

Figure 1 and 2: Graphs showing heat release and difference in temperature between sample upper surface and underside in cone calorimeter testing in a cable compounds containing Huber's Hydral 710 precipitated alumina trihydrate and Safire 400 nitrogen-phosphorus fire retardant

Source: Huber Engineered Materials

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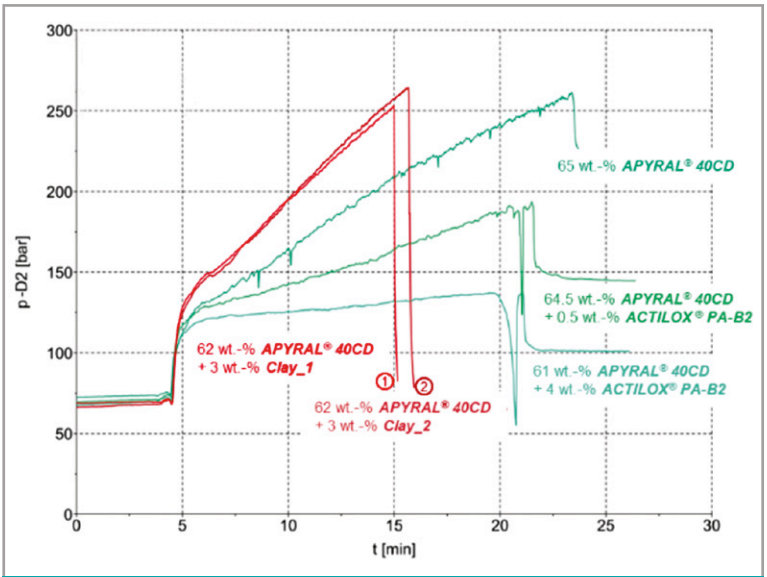


Figure 3: Pressure build-up over time of different flame retardant LLDPE/EVA formulations using the DIN EN 13900-5 filter pressure test. This determines the quality of the filler dispersion in the polymer matrix and the influence of mineral fillers on the pressure build-up during compounding and extrusion due to blocked screens. Compound obtained from the twin screw extruder was melted in a single-screw-extruder and conveyed through a 50µm filter. The pressure build-up in front of this filter was measured and evaluated.
Source: Nabaltec

pressure build-up during compounding and extrusion while maintaining a good mechanical and aging performance," it says. Nabaltec has summarised the features of Actilox PA-B2 in a **White Paper**, which is available on its website.

Russian Mining Chemical Company says it sees a growing number of aluminium composite panel (ACP) producers looking to move from B1/B2 (flame retardant) class panels to A2 (incombustible) class in accordance with EN13501-1. "During the last year we have received several times more requests for EcoPiren (based on Brucite, the mineral form of magnesium hydroxide) suitable for production of A2 core compounds in comparison with the year before. The main ACP products cluster is still rated as B1/B2, which is produced using the conventional extrusion technology," the company says.

"There is still a strong belief that an A2 core compound cannot be produced by extrusion, especially with acceptable density (which is about 1.75g/cm^3). That's why we dedicate a lot of our R&D resources to develop new EcoPiren grades and optimise the formulation for A2 class core compound to provide expected level of processability and density by extrusion," it claims. An intermediate result of this work is a new EcoPiren 400-1000 grade for continuous compression lamination. It has already been approved by several leading producers of A2 ACP.

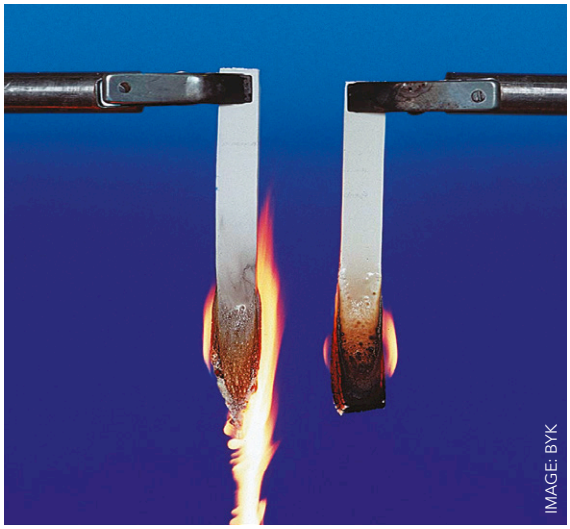
Quarzwerke's **HPF The Mineral Engineers** unit has developed what it says is an innovative flame-retardant material in cooperation with a well-known (but unnamed) automotive supplier and a large compounding company. HPF supported the project with various coated and uncoated Kaolin grades, with Kaolin TEC 110 EST showing the best overall performance in the compound. This is a platey phyllosilicate with a high aspect ratio. "With Kaolin TEC 110 we managed to develop a particular high aspect ratio quality with excellent reinforcing properties," says Péter Sebö, Head of Marketing & Market Development at HPF.

Sebö says the olefinic compound developed in the trials shows extremely good flame resistance and good long-term heat stability up to 150 °C. Mechanical properties, such as impact strength, are said to be excellent at temperatures down to -20°C. They were achieved using Kaolin TEC 110 in combination with various halogen-free additives. "In the event of a fire, no corrosive smoke gases are produced and the smoke gas development is hardly measurable," says Sebö.

The compound passed the glow wire test (GWT) at 750°C according to IEC 60695-2-10/11, with a 1.75mm penetration depth after 30 sec. At 800°C, penetration depth after 30 sec was 2.70mm. It achieves a UL94 V-0 rating and has very good resistance at 23°C and 60°C to various chemicals, including fuels and oils. Flammability tests were run with specimen thicknesses down to 0.8 mm. "We think that a V-0 below 0.8mm is also possible," says Sebö. The recipe and the precise loading of Kaolin is confidential, but is said to be more than 10%.

Targeting polyamides

Last year, **Byk** launched Byk-Max CT 4260, an organophilic sheet silicate for use in thermoplastics



Right: Fire performance of a PA compounds without Byk-Max CT 4260 (left) and with a 5% addition

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such as polyamides. The company says the product is especially suitable for use with HFFR compounds "since incorporating the additive improves not only the flame retardant properties but also the dropping behaviour and crust formation."

Byk-Max CT 4260 also enables the filler content – aluminium, or magnesium hydroxide, for example – to be reduced. This leads to a measurable improvement in processing and physical properties and to a reduction in the overall weight, Byk says. It can also enhance barrier to oxygen, water vapour, and hydrocarbons while increasing melt viscosity, enabling in some cases an improvement in dimensional stability during profile extrusion.

At **Budenheim**, Heiko Rochholz, Head of Marketing, says with its new Budit 617, the company "offers a new class of HFFR system that addresses the need for a higher GWIT (>800 °C) and less corrosion while processing."

Budit 617, which is based on melamine polyphosphate in a new synergistic combination, is intended for use in glass fibre reinforced polyamide 66, where it can provide up to UL94 V-0 at 0.8 mm. It does not discolour the polymer and does not migrate to the part surface. Decomposition starts above 340°C. "Due to its high phosphate and nitrogen content it acts as a flame retardant mainly in the solid phase [char formation] but has additionally a synergist (DOPO derivative) acting in the gas phase," says Rochholz.

Budenheim is also now offering Budit 669S, a development of its existing Budit 669 grade that is suitable for use in polyolefins, especially cables, tubes, and housings of white goods. 669S is an ammonium polyphosphate (APP)-based halogen-free flame retardant containing a special coating. Compounds using it are said to offer better mechanical properties. In addition, there is no migration and V-0 can be achieved at 1.6mm.

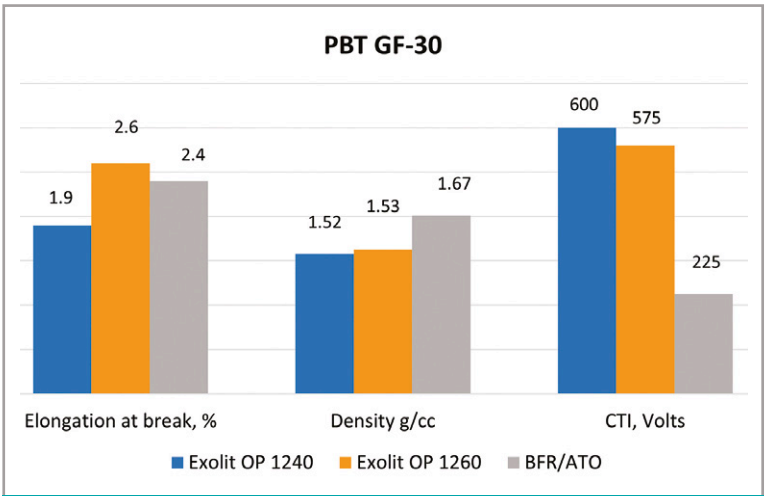


Figure 4: Clariant's Exolit OP 1260 flame retardant offers a good balance of properties in glass reinforced PBT compounds
Source: Clariant

Circular innovations

Addressing issues of the circular economy, **Clariant** says there is a growing need for flame retardants for polymeric compounds that are not only efficient and stable but also environmentally friendly. It says that for its Exolit halogen-free flame retardants for polyamides and polyesters, it has developed a rigorous method to screen products based on a catalogue of 36 criteria to determine their environmental impact. Based on this extensive evaluation process, products that meet the criteria can be awarded its Ecotain label. The company cites Exolit OP 1400 for polyamides as an example. It says it "combines sustainability with the ability to meet the stringent requirements of e-mobility like UL94 V-0 down to 0.4 mm and the best CTI of 600V."

For thermoplastic polyesters, Exolit OP 1260 has also been awarded the Ecotain label, in part due to good recycling performance demonstrated in a recent study of PBT 30% glass reinforced compounds with and without flame retardants. Specimens were moulded from fresh compound with the addition of 10%, 30% and 50% regrind. The Exolit-based compounds retained the flame retardancy standard UL 94 V-0 at all levels of re-grind addition. Even the afterburning times were not significantly affected, the company claims. The mechanical properties including elongation remained unchanged as well. "Under the conditions used in the test, Exolit OP 1260 can be used as a drop-in replacement to brominated flame retardants," says Clariant.

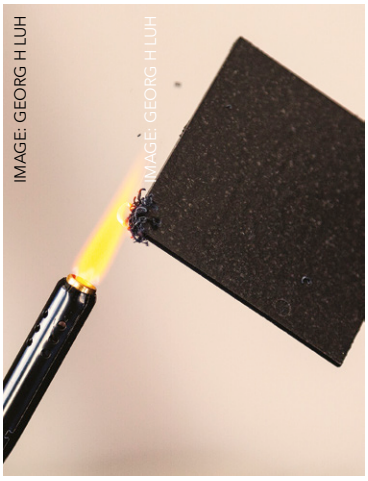
Progress is also being made in flame retardants based on graphite, with **George H Luh**'s new expandable graphite grade developed especially for polyamides. The company, which provides materials from various sources, says that, until now, the expansion initiation temperature of maximum 230 °C has limited the use of expandable graphite in polymers with relatively high melting points such as polyamide. "With our new generation expandable graphite GHL PX 95 HT 270, we have been able to develop a new grade that only develops its protective characteristic from 270°C," says Marketing Manager Angelina Schöffel. "It can be used for polyamides and applications with processing temperatures up to 260°C."

Quantities for sampling and first production trials are available now. The company says the next step is the development of expandable graphite grades with even higher starting temperature and various particle sizes.

Expanding research

The fire protection effect of the new expandable graphite and its processing in various polymers is being investigated in a research project between Luh and the Institute of Polymer Technology at the University Erlangen-Nuremberg in Germany. Combinations with different synergists such as MDH and APP, as well as further optimisation potential of the expandable graphite itself, form part of the project. Preliminary studies have shown that the intumescent layer acts as a heat shield that reduces heat generation and slows fire progress. The Average Rate of Heat Release (AHRE) is significantly improved and combustion is near smoke-free.

NeoGraf Solutions has been manufacturing carbon and graphite products for more than 135 years. It specialises in the development and manufacturing of natural and synthetic graphite sheets and powders for numerous applications. It recently added GrafGuard 280-50N to its line-up of expandable graphite flake, non-halogenated flame-retardant additives. The new grade is being targeted at compounds for injection moulded and thermoformed applications.

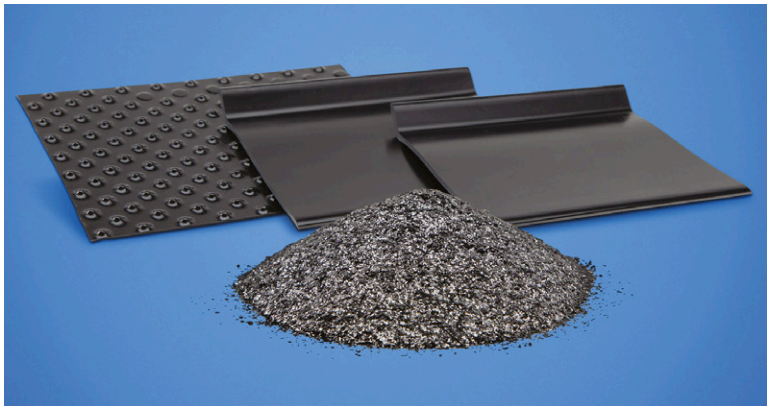


Above: A flame being put to a PA compound filled with expandable graphite

Above: Expandable graphite before (left) and after expansion (right)

With a particle size of 300 microns, GrafGuard 280-50N has an on-set (or expansion initiation) temperature of 280°C, which NeoGraf says is the highest on the market. "GrafGuard 280-50N offers customers a much wider range of polymer systems such as polypropylene, polystyrene, PET, nylon, and ABS, than our previous products," says Jeff Gough,

IMAGE: NEOGRAF SOLUTIONS



Above: NeoGraf Solutions says GrafGuard 280-50N expandable graphite flake additive is widely used as a flame retardant in thermoformed and extruded thermoplastic panels used in the aerospace and automotive industries

Product Manager for NeoGraf. The company recommends using MgOH as a synergist.

Radical alternatives

New FR developments at the **Fraunhofer Institute LBF** for Structural Durability and System Reliability focus on the extension of the oxyimide radical generator family. Previous oxyimide flame retardants comprising ester linkages influence processability of engineering plastics. The new family of oxyimide ethers is said to be compatible with polyamides and can provide UL 94 V-0 in PA6 at concentrations as low as 3%. Flame retardancy is provided through the formation of a glassy layer as a barrier, which Prof Dr Rudolf Pfaendner, Division Director Plastics at the institute, says seems to be a mechanism not seen before.

Another advanced research topic at LBF is the design of flame retardants based on renewable resources. These novel molecules combine active phosphorus species as part of a polymer chain synthesised using readily available raw materials such as cellulose, lignin, and pentaerythritol. One application area is to provide flame retardancy for biopolymers, most notably PLA. Adding 5% of flame retardant to PLA results in UL 94 V-0, whereas with a commercial polyester flame retardant a 15% loading achieves only V-2 due to burning dripping.

Synergist developments

Paxymer, which developed its own synergist for flame retardants, says it has been involved in several exciting developments during the year. "Due to improvements in the production of the synergist there has been a significant improvement in efficiency of the synergist itself," says CEO Amit Paul. "It improves residue levels in materials by more than 250% by adding 1-2 wt% of synergist in combination with conventional P/N systems."

The main benefits come from reducing the flame spread, eliminating dripping, and increasing gas phase availability of the P/N systems, enabling compounders to meet fire standards with a lower total level of flame retardant. "This often means cost savings - sometimes up to 20% on HFFR formulations," says Paul. Paxymer's latest development has increased the thermal stability so that that the synergist can be processed at up to 300°C. It is now also said to be easier to handle and less sensitive to moisture.

Preliminary trials have proven compatibility and efficiency in polyamides and ABS. "We were previously focused only on polyolefin plastics, but the new product is compatible more or less across resins," says Paul. The company has also developed new masterbatch formulations that are aimed at conduit and duct markets in PP and PE. Addition levels below 10% can achieve self-extinguishing performance.

Bansi L Kaul, CEO of **MCA Technologies**, says applicability of the company's morpholino-poly(piperazinyl-morpholinyl-triazine) proprietary universal fire retardant synergist and smoke and toxic gases suppressant has been extended beyond its original purposes. "It is now found that MCA PPM Triazine HF additionally acts as a heat stabiliser, beyond anti-oxidants, to retard visible and invisible degradation during melt-processing and reprocessing (recycling) of invariably high-loaded (and heat sensitive) FR compounds, such as PINFRs," he says.

Composed of C, H, N elements and characteristically insoluble, MCA PPM Triazine does not bloom or bleed during the service life of the plastics compound. "No matter in what polymer we tested we always found the stabilising effect," says Kaul. "PPM Triazine HF has also shown to be a facilitator for environmentally safer ultimate disposal of waste plastics, beyond recycling, thereby enabling energy extraction with least production of toxic gases." ❯

Table 2: Performance of novel polymeric bio-based flame retardants in PLA

PLA grade	Flame retardant	UL 94 V
low viscosity	no	V-2
low viscosity	15 % Polyester	V-2
low viscosity	5 % LBF-Polymer	V-0
high viscosity	no	Not classified
high viscosity	15 % Polyester	V-2
high viscosity	10 % LBF-Polymer	V-0

Source: R Pfaendner, Fraunhofer Institute

Composition	TGA °C**	LOI	UL 94
GF PA 66 (LANXESS)	N.C.	24.3	N.C
+ 20% OP1230 (Clariant)	331	48	V-1
+ 12% OP 1230 + 8% HF (MCAT)	373	37.3	V-1
+ 12% OP 1230 + 8% MPP (Budenheim)	291	28.3	V-0
+12% OP 1230 + 4% HF + 4% MPP	316	30.7	V-0

(** Onset of weight loss)

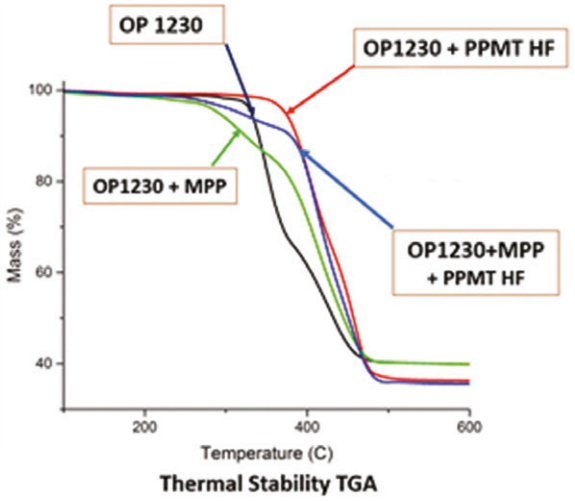


Figure 5: Table and graph demonstrating how MCA PPM Triazine improves thermal stability (TGA) and fire retardancy of 35% glass reinforced PA66 (Durethan AKV35CXH2.0 from Lanxess)

Source, MCA Technologies

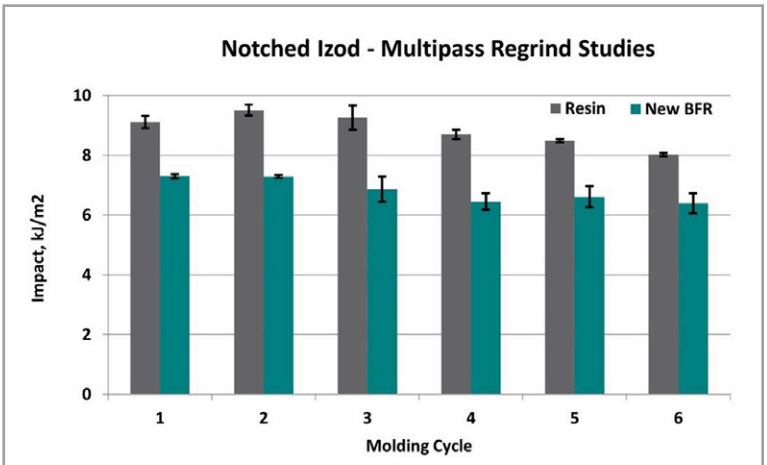


Figure 6: Notched Izod impact property retention of HIPS and HIPS compounds containing Saytex Alero polymeric FR after multiple recycling passes

Source: Albemarle

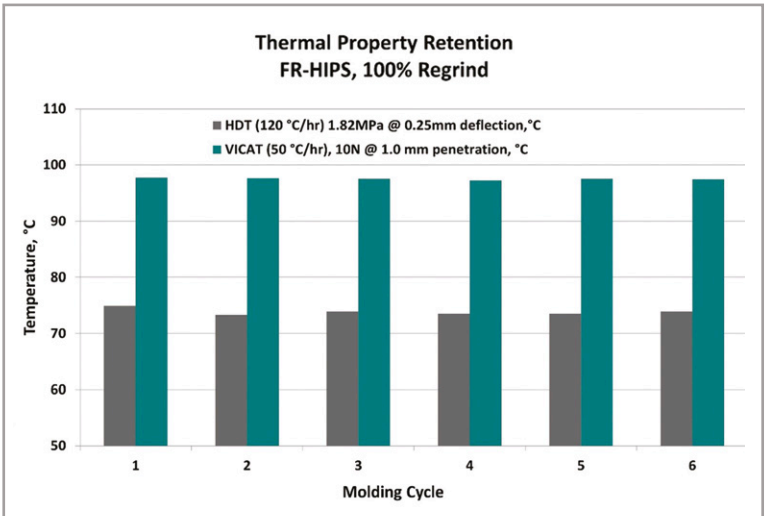


Figure 7: Thermal property retention study – HDT and Vicat – for Saytex Alero in HIPS after multiple recycling passes

Source: Albemarle

Backing bromine

Suppliers of bromine-based flame retardants (BFRs), which are still used in vast quantities in plastics and other materials, are holding their ground. Matt Von Holle, Vice President Global Business Leader Fire Safety Solutions at **Albemarle Corporation**, strongly defends bromine-based chemistry. Albemarle's diverse product offerings include large, brominated molecules in its Saytex branded portfolio, including 8010 ethylene-bis(pentabromophenyl), or EBP, and BT-93W ethylene-bis(tetrabromophthalimide), or EBTBP, both of which Von Holle says have excellent toxicology profiles.

"These molecules are non-bioaccumulative due to insolubility in water and organic media, including fatty oils," he claims. "Compounds of these molecules have also been tested in mechanical recycling studies, showing excellent retention of flammability, physical, mechanical, rheological, and thermal properties, oftentimes better than the base resin itself."

Von Holle goes on to say that a study in flame retarded high impact polystyrene (FR-HIPS) containing EBP mimicking post-industrial recycling (PIR) operations at the high end of processing temperatures (250°C) at 10% regrind level, found no observable change in EBP concentration via liquid chromatographic (LC) analysis after six moulding cycles. "Further, independent laboratory studies have confirmed no presence of dioxin or dibenzofuran in the EBP flame retardant raw material, nor in any thermoplastic formulation before or after mechanical recycling," he says.

Albemarle is continuing to develop what Von Holle calls new sustainable and high-performing brominated flame retardants. At flame retardant conferences organised by *Compounding World* publisher AMI in 2019, the company introduced a

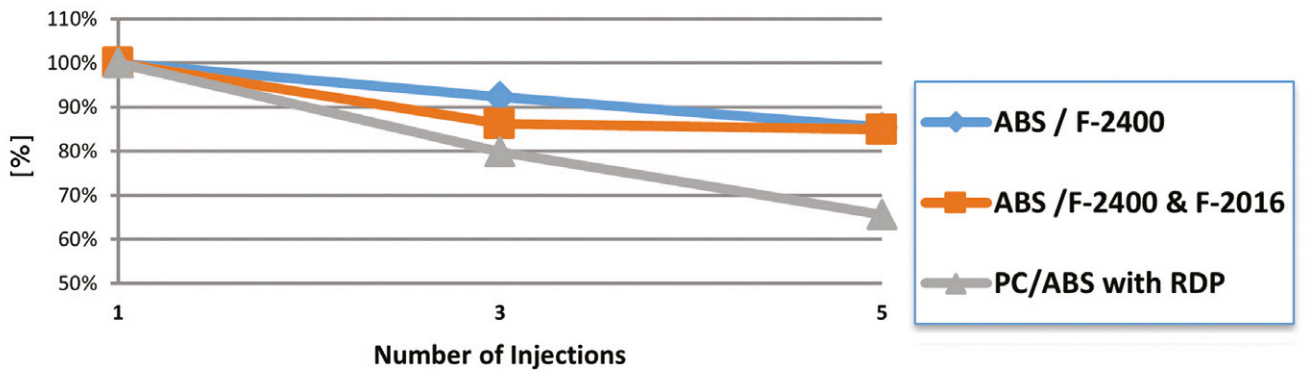


Figure 8: Change in Izod impact strength of different flame retardant ABS and ABS/PC formulations after recycling
Source: ICL

new polymeric FR – Saytex Alero – showing its thermal stability and suitability for recycling. It is said to exhibit improved performance characteristics in HIPS and ABS, including heat resistance and impact resistance, which were shown in an injection moulding study to be retained after multiple passes (Figures 6 and 7).

Recycling issues

At **ICL**, a major supplier of brominated and non-brominated flame retardants, Technical Marketing Support Manager Marc Leifer, together with colleagues Eyal Eden and Lein Tange, has also been looking at recyclability of FR compounds and how suitable different types are for electronic displays.

ICL reviewed typical compounds widely used in the manufacture of electronic displays. It put the compounds through five cycles of injection moulding and mechanical recycling. The first cycle involved virgin compound, while cycles two to five were performed by mixing 50% of the initial compound with 50% of recycled material from the previous cycle. Tests were performed at each stage on flammability, mechanical and rheological properties.

Three UL94 V-0 formulations were tested: two were based on ABS, containing respectively ICL's F-2400 polymeric high molecular weight epoxy brominated fire retardant (BFR) and ATO; and a blend of F-2400 with its F-2016 epoxy BFR and ATO. The third compound was based on PC/ABS (70/30), using ICL's Fyrolflex RDP as the flame retardant.

UL94 V-0 values were maintained throughout along all five cycles for the ABS/BFR formulations. The PC/ABS formulation maintained UL94 V-0 for the first cycle only and failed at cycles 3 and 5. Both ABS/BFR formulations exhibited an Izod Impact reduction of 15% through the fifth cycle (Figure 8). A 34% reduction was recorded for the PC/ABS/RDP formulation. ABS formulations showed a 23% increase in MFI (220°C/10kg). MFI for the PC/ABS formulation increased by over 200% (250°C/5 kg).

As far as resistance to heat and humidity were concerned, injection moulded specimens were aged under the following conditions: oven temperature 80°C; relative humidity 95%; ageing period of 168 hours. The ABS/BFR formulations maintained UL-94 V0, while the PC/ABS/RDP ended up with a rating of V1. The ABS formulations showed a decrease of 13-17% in Izod impact strength, while in the PC/ABS formulation it fell by 32%.

ICL also assessed the greenhouse gas emissions (CO_2 equivalents) of several flame-retarded TV housing formulations throughout the lifecycle of the products. The results showed that HIPS and ABS containing brominated FRs exhibit a lower carbon footprint (12.9 and 16.5kg respectively per housing) than a PC/ABS containing BDP (21.7kg).

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IMAGE: SHUTTERSTOCK

FR majors hit out at EU eco-design regulation

*Producers of brominated flame retardants have hit at looming EU eco-design regulations banning their use in electronic displays. **Peter Mapleston** finds out more*

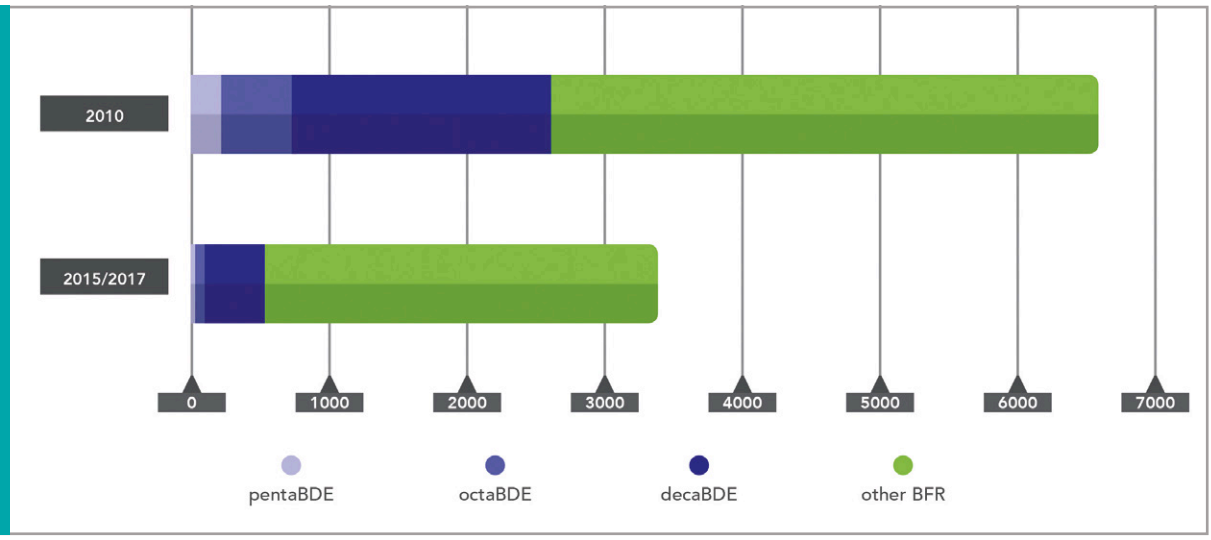
The European Commission published a **regulation** (Commission Regulation EU 2019/2021) containing new eco-design requirements for electronic displays in October 2019. Due to come into force in March next year, it includes a ban on the use of halogenated flame retardants (HFRs) in enclosures and stands of certain types of electronic information displays. In response, BSEF, the International Bromine Council representing bromine producers and producers of bromine technologies – members include Albemarle, ICL Industrial Products, Lanxess and Tosoh – have hit out at the move on the grounds of legal process and challenged its intended aim of improving WEEE recycling.

Addressing the legality of the European Commission's move, BSEF said the regulation is "unjustified and disproportionate and not coherent with EU legislation on chemicals [REACH] as it targets a whole class of flame retardants, including several brominated flame retardants, and bans them even though they are correctly registered and not subject to any regulatory restriction."

BSEF Secretary General Dr Kevin Bradley said: "The European Union has legislative instruments for addressing restriction of hazardous substances in electrical and electronic equipment and it's called RoHS. Equally, REACH provides for the restriction of chemical uses in articles and products. Clearly, the Commission has made a mistake and it needs to correct it."

However, BSEF goes on to criticise the main rationale for including the ban on the use of HFRs, which is that they hinder the effective recycling of WEEE plastics. "The facts on the ground within the

Main image: The International Bromine Council (BSEF) argues EU eco-design proposals to ban brominated flame retardants from electronic displays are based on misperceptions



Average levels of various brominated flame retardants in WEEE plastic (ppm) for 2015-17 period compared to 2010

Source: BSEF

recycling industry do not support this", said Bradley. "Yes, BFR-containing plastics do have to be separated and treated separately under the EU WEEE Directive, but this is being well managed by innovative plastics and polymer recyclers", he said.

BSEF has lodged formal proceedings against the European Commission in the European Court of Justice in Luxembourg. Bradley hopes for a hearing during Q1 2021, with a possible ruling before the end of Q2.

WEEE misconceptions

Meanwhile, the association released a comprehensive 46-page **report** last month covering WEEE plastics flows and recycling efforts in Europe. It says the report, undertaken by the SOFIES sustainability consultancy, "addresses misperceptions regarding the impact of Brominated Flame Retardants (BFRs) on WEEE plastics recycling and presents the successes and overarching challenges in making WEEE plastic streams more circular."

The report says approximately 2.6m tonnes of WEEE plastics are generated annually in Europe; plastics containing BFRs represent about 9% of this total. It also shows that already-restricted BFRs are a rapidly declining component of the total BFRs in WEEE plastics, which Bradley attributes to the effectiveness of RoHS restrictions (the use of Octa-BDE has been restricted in Europe since 2003 and Deca-BDE since 2008).

"Policy makers need to focus on the core issues here, namely the substantial volume of WEEE plastics which is leaking out of Europe and treated in a sub-standard way, as well as looking for solutions to recycling more of the high additive fraction of WEEE plastics," Bradley says.

According to the report, around half of all WEEE plastics generated in Europe does not enter official WEEE collection channels, ending up instead in the waste bin, processed at substandard recycling facilities, or exported outside Europe. On average, 55% of WEEE plastics entering specialised WEEE plastic recycling facilities are effectively recycled, meaning converted into PCR (Post-Consumer Recycled) plastics that can be used in the manufacture of new plastics products.

The report finds that the presence of BFRs in WEEE plastics does not reduce recycling yields more than other FRs as FR-containing plastics – as well as plastics containing other additives such as fillers in significant loadings – are sorted out during conventional density-based recycling processes.

Recycler suppport

The report's findings are supported by EERA, the European Electronics Recyclers Association. "The WEEE recycling industry has learned perfectly well how to deal with brominated flame retardants," the association says.

"REACH, RoHS and POP Regulation-compliant post-consumer recycled (PCR) plastics can be produced from the complex mix of WEEE plastics and these can be re-used in new appliances. The problems related to restricted legacy BFRs, as this study is clearly showing, are disappearing quickly," according to EERA.

However, EERA cautions that progress achieved to date will not be helped by further reduced thresholds for restricted BFRs. "The WEEE Directive requires us to separate all BFRs whether restricted or not. We rely on screening the element bromine to achieve this cost-effectively. However, we are now screening out more useful plastics with non-restricted BFRs than legacy BFRs."

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Halogen-free flame retardants for foamed PP parts and films

Unipetrol is developing a halogen-free flame retardant solution for expanded PP and thin polyolefin films

Automotive applications account for up to 10% of annual polymer consumption and demand from the sector is increasing, with one of the fastest growing areas being lightweight parts. These expanded foamed parts provide required mechanical and physical properties together with a weight reduction and material cost saving. However, such benefits must be delivered while maintaining low flammability.

Total flame spread and even final burning rate of a traditional compact plastic part can often be corrected by adjusting the wall thickness – increasing wall thickness decreases burning rate. In this way, the basic classification of burning rate according to international standards such as FMVSS 302, TL 1010 or ISO 3795 can be met in many polymeric parts without the addition of flame retardants.

Expanded lightweight parts are typically produced with higher wall thicknesses, but most of their interior volume is "polymer-free". An expanded lightweight part, therefore, displays flammability characteristics more like a thin sheet or film. Meeting the UL94 HF-1 classification for expanded foamed parts, which calls for near non-flammability and self-extinguishing properties without flammable liquid dripping, can represent a problematic issue.

Self-extinguishing properties can currently be achieved in PP using standard halogenated flame retardants in combination with antimony trioxide. The disadvantage is the growing concern over the accumulation of such additives in the environment and the inference of local toxicity. Therefore, the use of halogenated and antimony retardants is in decline and manufacturers are trying to replace them with lower environmental impact halogen-free additives.

A typical feature of many halogen-free flame retardants (HFFRs) is their ability to release water molecules at the burning temperatures of plastics, which reduces the heat of exothermic reaction from the system. However, to achieve high efficiency, such HFFRs have to be dosed at large amounts. This can negatively influence mechanical and polymer melt flow properties.

An alternative HFFR approach is based on the formation of an intumescent carbonised layer on the surface of the product, which prevents oxygen diffusion to the combustion center. However, a high mass of polymer is required to form such a layer, so the effectiveness decreases in lightweight and thin applications such as films.

The eco challenge

The challenge is to find suitable eco-friendly additives based entirely on halogen-free formulations with a balanced content of synergists. The resulting solution should meet the highest non-flammability class, but should not affect the mechanical, thermal or processing properties.

Unipetrol RPA is developing new halogen-free and eco-friendly flame retardant formulations for lightweight products, polymeric foams and thin films based on PP and PE. In cooperation with leading Czech manufacturers, the company in developing a new solution that meets most of the required specifications (before validation and launch, however, it will be necessary to further reduce the amount of non-flammable drips).

The synergistic additives used have high heat resistance, low extractability in water, and most of the organic solvents are soluble in the polymer during processing, which improves surface quality. Due to its low extractability and migration speed, the final product also meets strict criteria for migration limits and odour tests.

From a flammability point of view, the additive system is able to meet the highest non-flammability classifications for lightweight and thin film materials, including HF-1 and the VTM-0 standard horizontal burning rate test with a limit value of 80 - 100 mm/min. The innovative additives also aid the process of foaming and film stretching.

After completion of the development, Unipetrol intends to supply the new material as a ready-made compound or in the form of a masterbatch with a dosage level of up to 30%.

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Developments in the lab

Flexibility is a prime requirement for any laboratory compounding system. Peter Mapleston looks at how manufacturers are meeting that need in their newest introductions

IMAGE: AIMPLAS

Main image: This 18mm Leistritz laboratory system was installed in a cleanroom at the Aimplas institute in Spain this summer for medical compound development

The latest developments in equipment for compound and process development laboratories span extruders designed to process the smallest amounts of micro-pellets, through twin-screw extruders intended to handle both PVC and other thermoplastics, to machines that can easily double as small-series production lines.

Lab-scale compounding extruders for product and/or process development have evolved along with production-scale twin-screw machines in terms of torque density and maximum screw speed. According to Adam Dreiblatt, Director of Process Technology for **CPM Extrusion Group**, this means that for scale-up purposes, laboratory extruders need to operate at high output to duplicate the melt history in the production-scale machines.

"Most lab-scale extruders have enough power and speed - but not enough open area for feeding and venting," he says. With a 35kW water-cooled motor, the company's CXE26 machine (which with a 26mm screw diameter is well suited to development work) has enough power to compound up to 150 kg/hr, which drove the design for larger feed and vent ports.

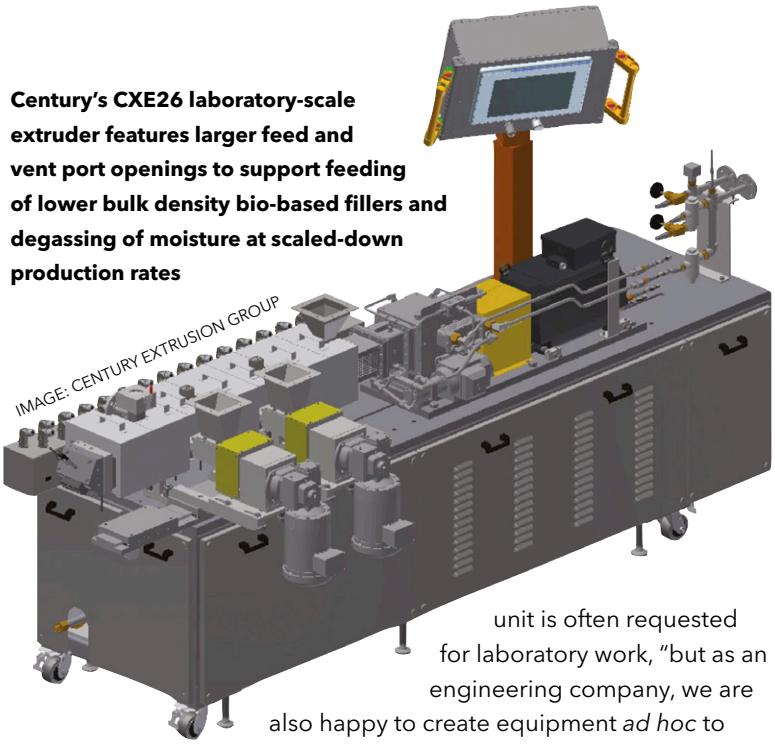
The i:o diameter ratio of lab machines should be the same as the production machines to facilitate scale-up, which means a 26mm machine with 1.55 d_o/d_i geometry provides the smallest channel depth which can easily accept pelletised resin. "The larger feed and vent openings on our CXE26 has proven to be a solution for companies running recycled resin or bioplastics, since these materials tend to have larger particle size and/or lower bulk densities and can utilise the full available torque that the CXE26 can deliver," Dreiblatt says.

He explains that small-scale compounding of recycled plastics and bio-based fibres also imposes substantially higher degassing requirements than other types of compound production, and this can become a problem with small extruders having relatively small vent openings.

When laboratory extruders are required to fulfil small-lot production orders, Dreiblatt says the company's larger diameter CXE32 and RXT35 models are often specified. These higher torque machines can still operate at low capacity for formulation development when not in production mode, he says, adding that the extensive portfolio of screw element designs, side feeders and vacuum vent stuffers available from CPM "enables robust compounding at any scale."

Scaling concepts

At Italian compounding systems producer **ICMA San Giorgio**, CEO Giorgio Colombo says the company's small 25mm extruders are based on the same concepts as its larger units and hence are highly suited to scaling-up laboratory developments to commercial production. In common with its larger equipment, the smaller model can be extensively customised according to customer requirements. He says that its slightly larger 30mm



Century's CXE26 laboratory-scale extruder features larger feed and vent port openings to support feeding of lower bulk density bio-based fillers and degassing of moisture at scaled-down production rates

IMAGE: CENTURY EXTRUSION GROUP

unit is often requested for laboratory work, "but as an engineering company, we are also happy to create equipment *ad hoc* to meet very specific customer requirements."

At the beginning of this year, ICMA opened what it calls an 'innovation hub'. Located next to its main plant at San Giorgio su Legnano, not far from Milan, it allows customers to rent space for a few weeks to carry out trials, to test compounding extruders integrated with ancillaries of their own choice, and to carry out small production runs before setting up lines in their own facilities.

The new resource, which is also used for ICMA's own innovation purposes, covers an area of around 1200m^2 – it is large enough to house three or four extruders at any one time. Colombo says it has already proved popular with clients despite the restrictions posed by the COVID -19 pandemic, which has on occasion meant customers remotely observing trials carried out by ICMA's staff experts.

Italian machinery maker **Maris** reports that, over recent years, the number of trials at its technological centre, which are generally carried out in cooperation with the customers' technicians and researchers, has been growing. Acoording to the company, a fundamental requirement for obtaining good results is to analyse both the needs of the chemists who study formulation aspects (feasibility with small quantities of raw materials and easy changeover of machine configuration, for example) and those of the process technologists, who are more interested in obtaining indications of the influence of process parameters on the morphological and physical and chemical characteristics of the compounds.

"In both cases, it is of utmost importance to monitor the process parameters in order to elaborate an energy balance and a first, even though approximate, estimate of the scale up," the company says.

Research focus

The TM20 Hi-Tech is the company's primary laboratory offer and is designed specifically for research activities. Area sales manager Luciano Battistuta says the basic model concept has been offered for several years, but that the company continually makes improvements in terms of configuration and process aspects. The 20mm unit is said to facilitate upscaling from laboratory to industrial production, featuring the quality, operational and performance characteristics typical of production equipment.

"One of the most interesting aspects of the TM20 Hi-Tech is the flexibility, which allows fast changes of configuration with respect to the raw materials introduced and the type of process," Maris says. "This can be easily done thanks to interchangeable and modular mechanical components, which do not require the intervention of specialised technicians."

Scale-up from this type of equipment is not immediate, Maris says, but can be calculated by considering different factors such as heat exchange (as a function of the barrel diameter) and feeding configuration for powders and/or liquids. The company can provide a calculation program to assist customers with scale-up on request.

The 16mm poex T16 Scientific from Turkish extruder maker **Polimer Technics** has been designed as a laboratory compounder for R&D applications and for optimising new product formulations. It is said to feature easy and highly flexibile operation due to a modular construction that allows screws and shafts to be changed very quickly.

IMAGE: ICMA SAN GIORGIO

Right: A customer compound development trial being carried out in ICMA's new innovation hub in Italy

Machines can be configured to the specific task. Screw and barrel materials can be selected to suit the application conditions and materials to be processed and, again depending on the application, degasifiers, side feeders, and melt pressure sensor mounting points can be incorporated. High-temperature and wear-resistant seals can also be specified for very low-viscosity chemical reactive extrusion work.

The poex T16 Scientific has a typical output rate of 1- 10kg per hour. A touch screen control system provides the opportunity to produce process data charts (specific energy input, for example) during the process and export the files to external systems. "Due to the fact that it requires only a small area and can easily be moved, the user gets the flexibility of a lab machine which can be designed and improved based on their demands" says Reha Yelken, Sales and Marketing Director at the company.

Close to production

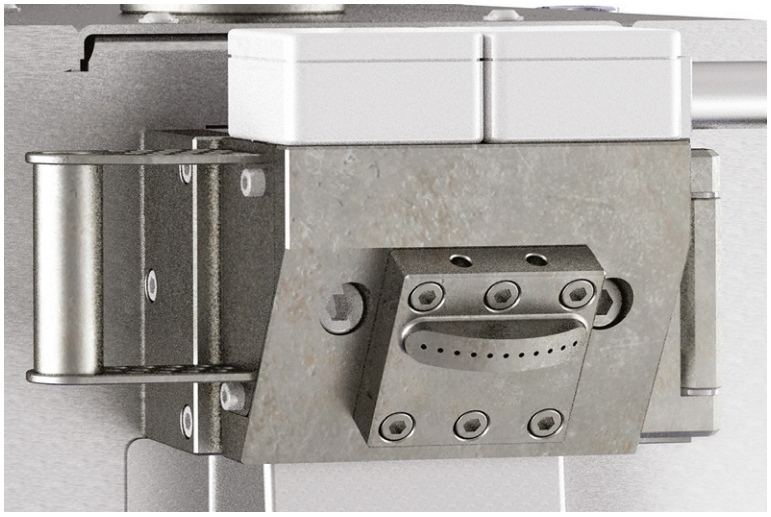
At the top end of what can be considered a laboratory compounding unit, Japan's **JSW** has launched a new addition to its 'TEX-αIII' twin-screw extruder series. The 34mm TEX34αIII replaces the company's TEX30α and features the company's EZ-Change tie-bar system, designed to simplify barrel changes

IMAGE: JSW

Left: JSW's TEX34αIII replaces the company's TEX30α model and offers improved barrel change technology

The TEX34αIII comes in standard and integrated configurations. The standard model is highly customisable and features multiple vents, can be configured with L/D ratios up to 77:1, and offers high screw speeds (up to 568rpm with a 37kW motor and 1150rpm with a 75kW motor). It can be

IMAGE: FEDDEM



Above: Production of micro-pellets at a laboratory scale can be challenging. Feddem says its curved FSK die heads, which carry up to 11 die holes, ease separation as the strands enter the water bath

supplied in an explosion-proof version. The integrated model has the control cabinet incorporated into its frame to reduce installation space and installation time, which limits the L/D ratio to a maximum of 52.5. Configurations for screws and barrel are customisable on both variants.

Germany-based **Feddem** says its Y-shaped funnel concept, which has proven itself in its production lines and can eliminate the need for a second side feeder, is now available on the laboratory compounding lines it produces.

The company says screw geometries using combinations of its FME-type mixing elements allow for simultaneous addition of powdered additives and short glass fibres through a single side opening in the extruder. This is due to the screw geometry's combined functions of melting the polymer, wetting the additive particles, and delivering distributive and dispersive mixing in one process. "In some applications this configuration enables formulations of 60% polymer compounded with 20% mineral powder and 20% short glass fibres via one side opening," the company claims.

The Y-shaped funnel concept provides optimal control of the powder and glass fibre feed by taking up the two feed streams at the discharge pipe of each metering feeder and guiding the material into the inlet opening of the extruder's side feeder. The feed streams are maintained separately until shortly before they enter the feed zone of the side feeder's conveying screws.

According to Feddem, the Y-shape of the funnel brings considerable advantages. Dust pollution around the side feed port is kept to the minimum, the company says, while the Y-shape funnel is considerably more compact than a conventional hopper. This means space limitations above the side feeder's feed port are eased and metering feeders can be placed for optimal access for reconfiguration and maintenance. "This is a tremendous benefit, especially in laboratory setups," says the company.

Venting option

Feddem says its FSE side venting concept, used for applications involving processing of low bulk density powders, is also now available for its laboratory extruders. The FSE concept actively reduces dust emissions when adding such additives. "In these applications, the stream of exhaust air from the compaction process during side

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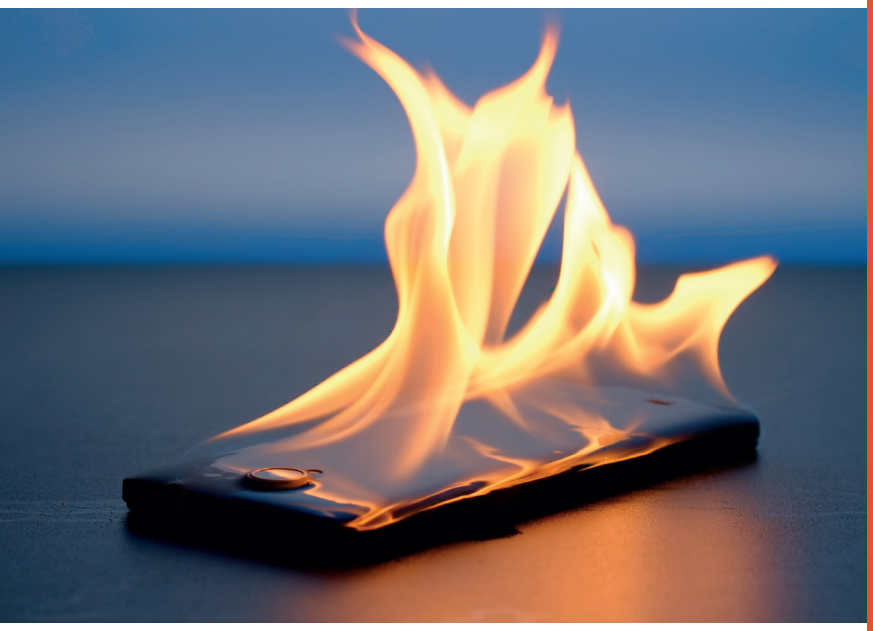

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Right and below: Labtech's latest 26mm twin screw extruder can be used with co- and counter-rotating screws to handle both PVC and other thermoplastics

IMAGE: LABTECH ENGINEERING

feeding passes through an intermeshing, co-rotating twin-screw arrangement that lets exhaust air pass while re-introducing particles back into the compounding process," says the company. There is no need for replacing filters or back-flushing. The company claims that, in certain applications, the FSE system can enable an increase in throughput of up to 30%.

As its name suggests, Thailand-based **Labtech Engineering** focuses on lab-scale processing equipment. Its latest and smallest twin screw compounder to date is the modular 12mm MicroCompounder, which has been designed to process 3x3mm size pellets as well as powders. While suitable for processing very small quantities of material for research applications, the company says it can also produce larger quantities and claims a maximum output of around 4kg/h.

Like other Labtech machines, the MicroCompounder can be supplied with various options, including gravimetric feeding systems, liquid feeders, and downstream water baths, air cooled conveyors and a selection of pelletisers. Each barrel zone is equipped with both water cooling and electric cartridge heating and the maximum processing temperature is 400°C.

Labtech has also further developed the 16mm version of its co-rotating twin screw extruder to include water cooling and electric heating on both the upper and lower barrel modules. This is said to allow for very precise temperature control at each zone, as well as more rapid cooling. The maximum barrel temperature is 400°C, making the machine suitable for most compounding options. Highly corrosion resistant screws and barrel inserts are also available.

Labtech also now offers a miniature single-layer cast film and sheet line. Built around a 16mm, 30-L/D single-screw extruder, the unit is said to be well suited for masterbatch producers needing to carry out quality checks during production as only a few hundred grams of material is required for each test.

Flexible for PVC

For compounders working with PVC and other thermoplastics, Labtech offers a machine with 26mm screws that can operate as a co- or counter-rotating unit. Company President Peter Jurgensen says the machine presents new possibilities for compounders that want to produce, for example, masterbatches based on both PVC and other thermoplastics.

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IMAGE: BAUSANO

Right: Bausano's MD30 co-rotating extruder can be used in direct production of PVC and polyolefin pipe

Most, if not all, PVC compounding lines use counter-rotating twin screws as the material's sensitivity to heat and friction makes the co-rotating compounding technology used for most other thermoplastics unsuitable. In the new extruder design, it is possible to switch between co- and counter-rotation simply by changing the screws and selecting the corresponding screw rotation option on the gear box. The standard model is supplied with an L/D ratio of 40, but Jurgensen says this can be increased substantially. The unit can also be fitted with side feeders as well as gravimetric dosing systems.

Direct options

Intended primarily for direct PVC production applications, **Bausano**'s MD30 counter-rotating laboratory extruder is designed to provide high mixing capacity at an extremely low number of revolutions. The machine is also said to be suitable for processing polyolefins for applications such as pipes that require the addition of high levels of fillers, masterbatches and additives. "We regularly process polyolefin pipes of various types on the MD30, with or without additives, and also thermoplastic rubbers and organic fibre compounds," says the company.

Two options for feeding solid additives are provided on the MD30: either through an additional volumetric or gravimetric dispenser mounted laterally at the same point as the main hopper (MD30/19), or further down the cylinder (MD30/30). "This newly designed line also makes it possible to change the position of the main supply by sliding it on side guides in order to set up the line as 30/30 or as 30/19," Bausano says.

Two options are available for feeding liquid additives: either into the supply outlet through a nozzle at the main supply, or half- or two-thirds of the way down the cylinder depending on the dispersion and mixing requirements of the various components. The 30/19 unit is equipped with one forced degassing unit, while the 30/30 model can have either one forced degassing unit or one forced and one 1 free degassing unit. Both versions of the MD30 are mounted on wheels.

Lab investment

Spanish technical institute Aimplas installed an 18mm diameter **Leistritz** ZSE 18 HP-PH laboratory extruder within a ISO Class 7/GMP cleanroom at its Plastics Technology Center at Valencia in August. "We want to expand our field of activity in the pharmaceutical (HME) and cosmetics industry, materials for bone and tissue regeneration and medical device developments among others," says Raquel Llorens, Health Senior Researcher at the institute.

The new machine is equipped with a side-feeder for conveying material downstream into the melt and is qualified in accordance with the latest GMP guidelines, including the control system. According to Leistritz, the ZSE 18 HP-PH twin screw compounding extruder design is well suited to the hot melt extrusion, wet granulation and filament extrusion processes Aimplas plans to use and is suitable for developing formulations as well as small batch production. It adds that all ZSE HP-PH machines from 12 to 50mm screw diameter share the machine geometry to simplify scale-up.

Japanese compounding research and development company DJK Corporation, which is located in Chiba, recently took delivery of a ZSK 32 Mc^{18} twin screw extruder from **Coperion**. Configured to provide maximum flexibility in laboratory operation, the machine can be equipped with ZS-B side feeders, Feed Enhancement Technology (which optimises material intake capacity) and ZS-EG side devolatilisation unit. Coperion says its cooperation with DJK also means that Coperion customers in Japan now have a testing area at their disposal.

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Tags keep tabs on plastics

IMAGE: DOTZ

Microscopic markers allow traceability of plastic materials as an anticounterfeiting solution but also present a potential means to sort and authenticate recycled plastics. Jennifer Markarian learns more

Counterfeit products are a serious and growing problem. They can certainly cause economic losses, but they can also damage a brand's reputation and even harm the end-user if the counterfeited item doesn't perform as expected.

"Globally, we have seen an increase in unauthorised production (excess production of genuine product sold outside approved retail chains), illegitimate production (fake/sub-standard product), and diversion (movement of genuine product between markets/customers to avail of arbitrage opportunities)," says Barry McDonogh, Senior Vice President of Sales and Business Development at US-headquartered **TruTag Technologies**.

The surge in demand for medical devices and personal protective equipment (PPE) over the past year – and the global shortages that resulted –presented a huge opportunity for producers of counterfeit goods, putting users at risk and posing liability issues for brands. Anticounterfeiting solutions for marking legitimate products are seen by many as part of the solution to this problem. A range of techniques are used to uniquely identify a brand's product and prevent copying, including visible methods such as laser-marking with the brand's text or images, use of holograms, or use of certain colours associated with the brand.

"With laser marking, you can make a product unique, providing useful technical information (from series numbers to QR codes) as well as consumer-related information such as designs and texts to make your brand stronger," explains Diego Karpeles, Corporate Brand Manager at Austrian masterbatch maker **Gabriel-Chemie**, which offers additive masterbatches that enable laser marking.

Because overt markings are at risk of counterfeiting, however, they may be used in combination with – or replaced by – covert markings that are invisible to the eye but detected by a device that scans the product to look for the mark. This might be a printed image detectable only under ultraviolet (UV) light or a phosphor particle that emits visible light under infrared (IR) light.

Luminescent phosphors in a variety of forms, including powder and masterbatch, are available from **Microtrace** but the company cautions that this solution provides a relatively low level of anticounterfeiting security because it can be

Main image: Markers such as ValiDotz are invisible to the naked eye and can be embedded in plastics during processing to provide secure product or package authentication

TruTag microtags are based on nano-porous silica and can be readily incorporated into masterbatch

IMAGE: TRUTAG TECHNOLOGIES

copied. It also offers Enhanced Phosphors – ceramic particles that can be multiple colours and can be triggered by either IR or UV light for greater security.

Nano sophistication

Microscopic, nano-scale, or molecular-level markers present an even more sophisticated and difficult-to-copy covert anticounterfeiting method. Such particles can be embedded in a plastic product or package during manufacturing, or embedded in or printed on a label. A detector is used to pick up the spectroscopic signal of the tags, which can be coded to contain detailed information.

IMAGE: MICROTRACE

Right: Microtaggant particles from Microtrace carry a unique numeric code in their layered structure

Microtrace's Microtaggant Identification Particles contain multiple layers that translate to a unique numeric code. Although it is a highly secure solution, the company says microtaggants are often less expensive in bulk-tagging applications than using standard phosphors. The particles are available in different sizes ranging from 20 to 1200 microns and can be supplied as a powder or masterbatch. It says the microtaggants can be detected and authenticated using microscopes, UV lights, or laser pens. The company also offers the products as part of its Summit Authentication Platform, which combines taggants, a detection system, and cloud-based analytics and reporting.

TruTag microtags from **TruTag Technologies** are based on nano-porous silica. "Our spectrally encoded taggants can be mixed as part of a masterbatch and extruded into a plastic or can be applied directly to a plastic part. It depends on the problem we are addressing and the technical/economic constraints of the scenario. Depending on the scenario, our taggants can be authenticated using a cellphone proprietary imager or forensic recovery," says McDonogh.

Common uses in plastics are for tracking unauthorised and illegitimate production and for dealing with warranty claims for product failure when the product turns out to be a counterfeit. "We have also seen interest from companies who wish to prove plastics have been recycled or that they contain additives to speed decomposition," adds McDonogh.

TruTags are also being used in healthcare applications to mark medical devices and consumables. One use is the tagging of medical consumables to ensure that only approved consumables can be used in a device. In this case, a small, cost-effective sensor is placed directly into the medical device and when a consumable is used it senses whether the tags are present, explains McDonogh. TruTags are also being used to tag PVC used in blister packs for pharmaceuticals and nutraceuticals.

Random solutions

Product authentication technology from **Polysecure** is based on the company's own fluorescent markers and compact optical detectors and interest has grown steadily in the past few years, according to Managing Director Jochen Moesslein. "A new innovation is the use of the random pattern of fluorescent particles in polymer matrices. These 3D patterns are not reproducible and thus forgery proof. They create an individual fingerprint in polymer products," he says. This physical code can link the product and its data in Industry 4.0 systems as a type of 'material passport' that provides relevant product data from manufacturing to the end of product life, he says.

Polysecure worked with Institut Charles Sadron

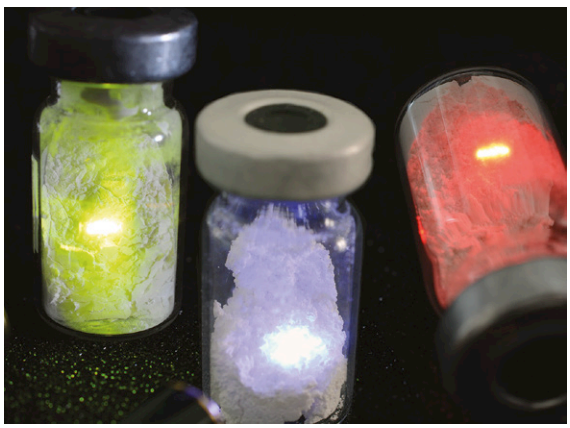

IMAGE: POLYSECURE

Right: Polysecure of Germany has developed a range of fluorescent markers for product authentication

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Right: Verimaster marker masterbatch was originally developed to ensure incorporation of critical additives such as antimicrobials

to create a thermal and chemically stable polymer taggant called POLTAG. Moesslein describes it as a "disrupt" technology. "These sequenced defined oligomers can be synthesised in billions of variations, which can be identified by tandem mass spectroscopy," he says. The technology can be used in plastics for tracking polymer batches for medical device production or for tracking recyclate content in plastic products.

One application for anticounterfeit technologies is to ensure the presence of critical additives in a polymer compound and this has already been exploited by **Addmaster**, which produces antimicrobial additives. "Addmaster were one of the first to explore this area when we developed an anticounterfeit range to allow customers to identify if our Biomaster [antimicrobial] additives were present," says Paul Morris, Founder and CEO of the UK-based company.

"We had to protect our clients from issues of our product not being added (deliberately or by accident) and also to prevent substitution at the point of manufacture. With the Covid-19 pandemic this is as important as ever, as the market is being flooded with copycat and inferior technologies, and our global clients want to make sure they are using the Biomaster technology," he says. Morris adds that, even outside of this application, the need for plastic product authentication continues to be strong. Its Verimaster additive masterbatch is a covert marker detectable with sensors or in-house lab testing.

Fluorescent markers

Masterbatch maker **Gabriel-Chemie** introduced its TagTec masterbatches containing inert, microscopic fluorescent particles at K2019. The fluorescent particles are excited by UV-A light (approximately 310 to 380nm wavelength), and the colour of the

IMAGE: ADDMASTER

tags detected by either inline or offline instruments that measure the primary emission (in the UV-A range) and the secondary emission (in either the visible range or the near IR range). Some tags are phosphorescent, and instruments can be used to detect the rate of fading of the phosphorescence. **Sensor Instruments** of Germany developed reading devices for TagTec, which include the Lumi-Mobile hand-held units, Lumi-Lab laboratory devices, and Lumi-Inline process detectors.

Gabriel-Chemie explains that there are two methods of detection: Star coding creates a specific reference area (on a bottle cap for example) where the encoded information can be detected; Tau coding can be read from any part of the object and is material rather than part-specific.

Monitoring products containing TagTec technology can be beneficial along the entire supply chain, the company claims. "A very important feature for medical and pharmaceutical products is the single material identification that provides a product DNA and enables the producer to track the basic material properties of each single produced item, such as series number, production date, raw material tracking, and invoice number," explains Karpeles. The company adds that TagTec technology can also be used for separating recycled materials (using Tau coding) and for process control by using part-specific information that can be matched to process data.

Australian company **Dotz** introduced its ValiDotz security markers, which can be used to tag and authenticate most thermoplastic and thermoset materials, in 2017. The carbon-based markers are intended to be embedded in the polymer, are detectable with UV light and can be authenticated using the company's InSpec mobile phone-based detectors. "The marker represents a unique code combination. When the marker is scanned, the device communicates this code to the cloud

Right: Detecting the presence of Gabriel-Chemie's TagTec markers using a hand-held reader

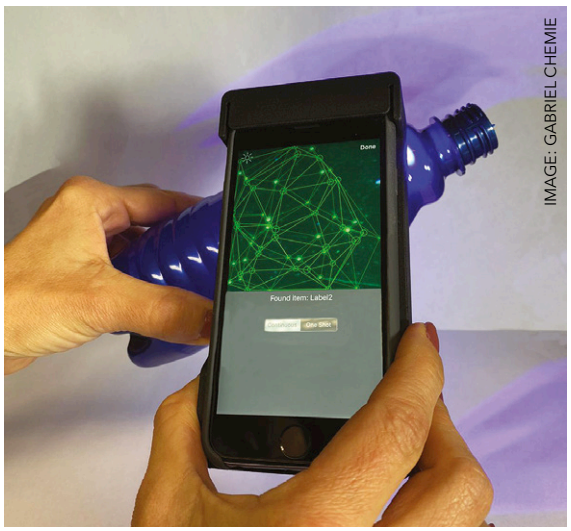

IMAGE: GABRIEL CHEMIE

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IMAGE: SHUTTERSTOCK

Above: Tracking and authentication of recycled polymer usage is an area of growing interest. Dotz believes tagging technology could present a solution

database and returns the information that is associated with this code. If the code does not exist in the system, or has been modified/tampered with, the system will recognise it and register the product as suspicious or fake," says Dotz's Chairman and Interim CEO Bernie Brookes.

Dotz provides the markers on a silica carrier for masterbatch production and the company works with a compounder in Europe to offer ValiDotz as a masterbatch or ready-made compound, according to Brookes. He says the markers work well even in black pigmented systems, which can typically be a challenge to mark. Although black pigments absorb a high level of visual light, the ValiDotz "react to UV light and possess high quantum efficiency," he explains. The InSpec reader excites the surface of the sample with a wavelength characteristic for specific ValiDotz markers and reads its unique emission pattern, he says.

Pandemic protection

The markers can be used in various plastics products, including automotive parts, toys, safety equipment, medical devices, and pharmaceutical packaging. Over the past year, there has been a surge in counterfeit personal protective equipment (PPE). US customs agents, for example, seized more than 10m counterfeit face masks between the start of the pandemic and 30 June.

"Demand for authentication is primarily being driven by PPE manufacturers, who are looking to improve the transparency of their supply chains to protect their brand reputation during the pandemic," says Brookes. "As the percentage of frontline workers contracting Covid-19 globally continues to increase, healthcare facilities and workers are also seeking to verify they are using high-quality PPE products."

Dotz is working with PPE manufacturers to authenticate their products by incorporating security markers either directly into the PPE or into a label. Dotz signed a three-year agreement with Canadian PPE manufacturer Breathe Medical for authentication of its respiratory face masks. The markers may be embedded into the fce mask, or used in packaging bags, boxes and cases.

For tracking PPE in packages, the ValiDotz markers are added to a geo-specified, trackable QR code that is added as a label to polybags, boxes, or the PPE itself. "The Smart Trackable QR codes are a complementary authentication technology that are applied to the surface of the products, either by labels or direct printing. Our Smart trackable QR labels include up to seven layers of digital and physical security features, with full track and trace capabilities, including geofencing, supply chain monitoring, and more," Brookes says. The label can be scanned along the supply chain, and each item is coded and associated with a digital fingerprint in the cloud. This system can provide real-time alerts on suspicious activity.

The company reported a flurry of other agreements during the third quarter of 2020 for anti-counterfeiting and tracing capabilities using its "Secured by Dotz" solution. A three-year contract for face masks and other PPE (valued at US$1.6m) with TT Medical Group in Turkey will trace PPE in eight countries across Europe and Africa. Dotz also signed a two-year agreement with Australian distributor V2Tech to authenticate face masks and the company is working with Hong Kong-based distributor UEG to authenticate medical gowns and face masks.

Recycling ideas

Like other taggant technology players, Brookes also identifies recycling as an emerging market. He says the company has had multiple requests regarding using the Dotz technology to track recycled plastic and is currently working on developing such a solution based on its ValiDotz technology, which he describes as a good fit for this application because it is sensitive to dilution.

"Using ValiDotz it is possible to determine the exact loading of a marker in the product. For tracking recycled products this makes the most sense, as you will always have a stream of fresh polymer and a stream of recycled polymer. Deviation from the calibrated value may indicate that a product contains more or less recycled material, and that feature can be used by both consumers and regulators to determine how they treat a specific product," says Brookes.

Other benefits include the use of light fluorescence (rather than radiation) for detection and that

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IMAGE: PELLENC ST

Above: Sorting systems company Pellenc ST sees digital marking helping to improve recyclate quality

the Dotz cloud platform can accommodate tracking of recycled products. The fact that Dotz can tailor the heat-resistant marker's properties to specific customer needs is also seen as a plus – some markers can be decomposed after several recycling cycles while others remain in the material after recycling for hundreds and even thousands of cycles, according to Brookes.

Aside from detecting recycled content, markers have also been evaluated as a means to sort material within recycling streams. **Polysecure**'s Tracer-Based Sorting (TBS) technology, for example, was first demonstrated in a project to separate PVC with glass fibre-reinforcement from PVC without glass fibre. Since then, Polysecure has developed new tracers that enable TBS to work (with some modification) using conventional NIR sorters.

Polysecure's Moesslein says new tracer materials have since been developed and validated that enable sorting of plastic packaging material into 20 to 40 pre-defined material fractions to create highly specified recyclate. The company now has two TBS options: TBS light and TBS complete technology. He says that strategic feasibility studies with leading brands and utilities are underway.

A related technology using Polysecure's markers printed on packaging labels to improve sorting of post-consumer recyclate was commenced in Germany in 2017 in collaboration with Pforzheim University, KIT Karlsruhe Institute of Technology, Werner & Mertz, and Der Grüne Punkt – Duales System Deutschland. The MaReK project (marker-based sorting and recycling system for plastic packaging) demonstrated that packages could be reliably sorted using codes (for material type or brand) in the markers.

Right: Representation of a HolyGrail digital watermark on a package (the actual watermark is invisible to the eye)

IMAGE: HOLYGRAIL 2.0

Sorting improvements

Another label-based technology for sorting recyclate is being evaluated in the much-publicised **HolyGrail 2.0** project, which is using digital watermarking technology from **Digimarc** as an invisible barcode in a label (either an in-mould label or sleeve) or moulded onto the part surface. The industry project is being facilitated by AIM, the European Brands Association, which includes global brands such as P&G (which pioneered the technology) and PepsiCo. Digimarc said in September that it had delivered its technology for sorting using the digital watermarks to sorting equipment companies Tomra Sorting Solutions and Pellenc ST.

Pellenc ST co-founder and R&D Manager Antoine Bourley says the company sees the technology as a potential solution to improve plastic recycling quality. "Pellenc ST is convinced that marker technology is an interesting opportunity to sort food packaging from non-food applications. Our cooperation with Digimarc to assess the potential of the technical solution in sorting plant conditions is a unique chance to accelerate the potential market penetration," he says.

UK-based **Nextek** works with clients to develop plastics recycling solutions and one of their projects is the consortium-based NextLooPP for polypropylene packaging. The group's PRISM technology (which stands for Plastic Packaging Recycling using Intelligent Separation technologies for Materials) uses luminescent markers applied to packaging labels to enable sorting.

Future legislation and the ongoing push by brandowners to use more PCR is expected by some to create a need for certifying PCR content. Identifying markers in the material could possibly fill this need, although cost is a question. **Circularise**, based in The Netherlands, uses blockchain and other technologies to enable transparency in the plastics supply chain (you can learn more about the use of blockchain in industry supply chains **HERE**). The company works with organisations such as Covestro, Domo and others to trace materials and communicate information about them to customers and regulators. ›

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Above: The combination of digital markers with blockchain data security is being explored by BASF to underpin claims of production circularity

In addition, Circularise is building an Open Standard for Sustainability and Transparency. This is described as a decentralised information platform that enables anonymous information exchange and uses "material passports" to give materials an identity and trace them using a variety of identifiers, including QR codes and embedded tags or markers. This information (raw material composition, material origin, for example) can be used to make plastics more "circular" in several ways, including allowing recyclers to sort materials more specifically and to identify a material's source.

In a new project with Porsche, Circularise, Borealis, Covestro, and Domo Chemicals are using traceability to track sustainability metrics of the materials in the supply chain for Porsche cars. "For us, it is really important to share information and be more transparent while maintaining confidentiality," says Burkhard Zimmermann, Head of Resin, Digital Transformation & Sustainability in **Covestro**'s Polycarbonates segment. "For instance, the material composition is of competitive advantage so we would never share that openly. Here, Circularise helps us to maintain this confidentiality and only disclose the information needed from raw material producer to recycler. And with that, we can close the loop."

The Circularise Plastics Group (Circularise, Domo Chemicals and Covestro) recently announced a collaboration with the European Plastics Converters Association (EuPC) to develop a tool to monitor the use of recycled plastics. This year the companies are working on finding synergies between the Circularise and MORE (Monitoring Reyclates for Europe) systems and identifying companies that want to test it for reporting of the use of recycled plastics.

Blockchain and digital badge and loop count technology is also being evaluated by **BASF** to share data and improve sorting, tracing, and monitoring of plastics throughout the value chain. The reciChain platform was first piloted by BASF in Brazil, where it is said to have improved transparency and compliance with recycling documentation. Early this year, BASF launched a further reciChain pilot in British Columbia, Canada, as a collaborative effort with several companies and retailers along the value chain to demonstrate circularity—not only recycling, but using the material over again in multiple "loops".

Blockchain tracking

The reciChain pilot uses marker technology from Australia's **Security Matters** to mark plastic materials and code them with information associated with the material. These markers are compounded into the polymer and can be read with the company's detectors to track the physical movement of the plastic material. The physical object is connected to a digital record that goes with it throughout its lifecycle, explains Haggai Alon, Founder and Chief Executive Officer of Security Matters. A blockchain-based platform takes the digital records and makes them visible to various stakeholders throughout the value chain.

Last month, the project collaborators reported that the reciChain pilot had successfully demonstrated the ability to track material through the value chain for a rigid HDPE bottle and a flexible PE stand-up pouch. The technology was proven in a small, controlled environment; the next step is likely to include further development of the technology and testing at a larger scale.

"By providing transparency of product lifecycles, we can create an entire technology-driven ecosystem that promotes circularity and sustainability for plastics. Together we can accelerate the progress of the plastic industry towards a more innovative, resilient and productive economy," says Alon.

CLICK ON THE LINKS FOR MORE INFORMATION:

- **www.trutags.com**
- **www.gabriel-chemie.com**
- **www.microtracesolutions.com**
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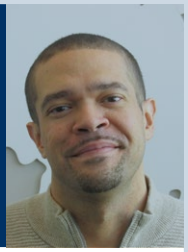

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David Buckby
Principal Global Resin Analyst

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Technical assistance and development

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SLENTEX – The space saving, non-combustible insulation
Dr Wibke Lölsberg
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BASF We create chemistry

Drill, Punch, Skive – The Hole Truth
Speakers:
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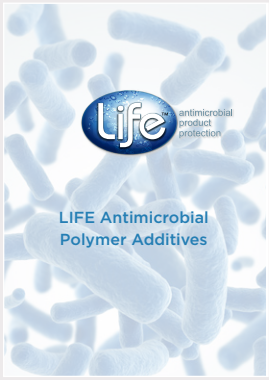

Life Material Technologies offers a full range of antimicrobial additives for protection of plastics from bacteria, fungi and algae, including silver inorganics, synthetic organics and natural botanics. Find out more in this four-page brochure.

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COPERION: FEEDING TECHNOLOGY

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

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BUSS: COMPEO KNEADER

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

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LEISTRITZ: MASTERBATCH SYSTEMS

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

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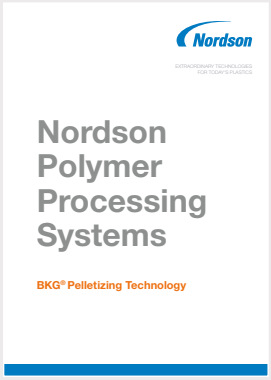
NORDSON: BKG PELLETISERS



The BKG range of pelletisers from Nordson Polymer Processing Technology includes underwater, water-ring and strand systems suitable for almost any thermoplastic pelletising application. Find out more in this six-page brochure.

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STRUKTOL: CREATIVE RECYCLING

Struktol offers a full range of additives to enhance performance of recycled compounds. This brochure details its extensive range of lubricants, PP viscosity modifiers, homogenisers and odour control products.

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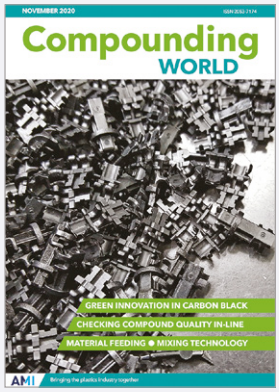

Compounding World November 2020
The November issue of Compounding World looks at how innovations are providing sustainability solutions in carbon black. Other features focus on checking compound quality in-line, developments in material feeding and the latest in mixing technology.

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Compounding World October 2020
The October edition of Compounding World looks at how additives can enable the use of recycled plastics, explores alternatives to twin-screw compounders, and investigates the state of the TiO_2 market.

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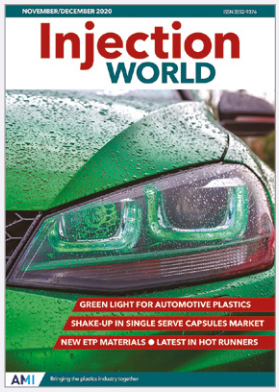

Injection World November/December 2020
Injection World's November-December edition has features on materials for automotive interiors and exteriors, new ETPs, the latest in hot runners, plus an article by AMI Consulting on a shake-up in single-serve capsules.

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Plastics Recycling World November/December 2020
The final 2020 edition of Plastics Recycling World looks at the latest developments in the world of plastics granulation. This edition also reviews innovations in PVC recycling and examines some applications of automated quality control technology.

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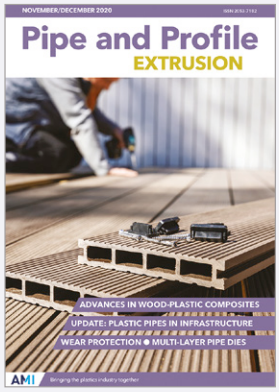

Pipe and Profile November/December 2020
The November-December issue of Pipe and Profile Extrusion has in-depth features which cover infrastructure pipe, innovations in wood-plastic composites, the latest in multi-layer pipe and an update on extruder wear.

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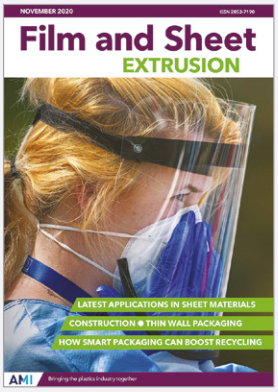

Film and Sheet November 2020
The November issue of Film and Sheet Extrusion contains in-depth features covering sheet materials, thin wall packaging, construction applications and how smart packaging can help improve recycling. Plus news from around the global industry and regular features.

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GLOBAL EXHIBITION GUIDE

2021

9-12 January	Arabplast 2021, Dubai, UAE **POSTPONED**	www.arabplast.info
26-29 January	Interplastica, Russia, Moscow **CANCELLED**	www.interplastica.de
4-8 February	PlastIndia, New Delhi, India **POSTPONED**	www.plastindia.org
25 Feb-3 March	Interpack, Dusseldorf, Germany **CANCELLED**	www.interpack.com
3-5 March	Asiamold, Guangzhou, China	www.asiamold-china.com
9-11 March	JEC 2021, Paris France **POSTPONED**	www.jec-world.events
22-26 March	Plastico Brasil, Sao Paulo, Brazil	www.plasticobrasil.com.br
13-16 April	Chinaplas 2021, Shenzhen, China	www.chinaplasonline.com
4-6 May	Kuteno, Rheda-Wiedenbrück, Germany	www.kuteno.de
4-7 May	Plast 2021, Milan, Italy	www.plastonline.org/en
17-21 May	NPE 2021, Orlando, FL, USA	www.npe.org
1-2 June	Compounding World Expo Europe, Essen, Germany **NEW DATE**	www.compoundingworldexpo.com/eu/
8-11 June	Moulding Expo, Stuttgart, Germany	www.moulding-expo.de
15-18 June	FIP, Lyon, France **NEW DATE**	www.f-i-p.com
22-25 June	Colombiaplast, Bogota, Colombia **NEW DATE**	www.colombiaplast.org
10-12 August	Feiplar, Sao Paulo, Brazil **NEW DATE**	www.feiplar.com.br
12-16 October	Fakuma, Friedrichshafen, Germany	www.fakuma-messe.de
14-18 September	Equiplast, Barcelona, Spain **NEW DATE**	www.equiplast.com
3-4 November	Compounding World Expo USA, Cleveland, USA **NEW DATE**	www.compoundingworldexpo.com/na/

AMI CONFERENCES

18-20 January 2021	Post-Brexit Regulations **VIRTUAL WORKSHOP**
19, 26 January, 4 February	Polymer Foam 2021 **VIRTUAL SUMMIT**
21, 28 January, 4 February	Polymers in Footwear **VIRTUAL SUMMIT**
23-25 February 2021	Fire Resistance in Plastics **VIRTUAL SUMMIT**
2-4 March 2021	Chemical Recycling USA **VIRTUAL SUMMIT**
16-18 March 2021	Functional Fillers **VIRTUAL SUMMIT**
20-21 April 2021	PVC Formulation, Cleveland, OH, USA
27-29 April 2021	Thermoplastic Concentrates, Coral Springs, FL, USA
10-12 May	Masterbatch Europe, Cologne, Germany

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

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PLASTICS EXTRUSION WORLD EXPO

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3 - 4 November, 2021

CLEVELAND, OHIO

www.ami.international/exhibitions

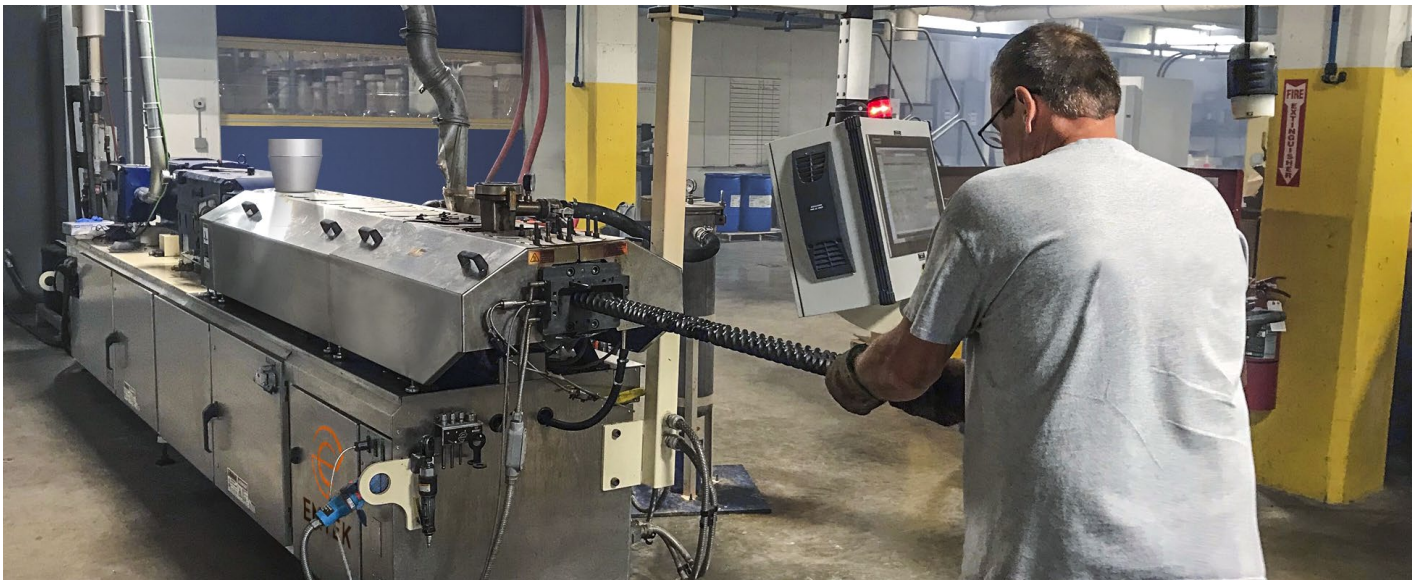
NOVEMBER 2020 EDITION

Extrusion Solutions

THE LATEST EXTRUDING NEWS FROM ENTEK

JEDA Polymers, LLC Engineered Thermoplastics CHOOSES ENTEK

Leading Midwest Compounder Gains Competitive Advantage with ENTEK QC^3 Machinery, Vacuum Feed Technology (VFT)



Sam Steffen, Maintenance Manager at JEDA Polymers, performing a screw change on the ENTEK QC^3-43mm twin-screw extruder

JEDA Polymers is a leading compounder and supplier of thermoplastics for injection molders. They offer a range of standard, specialized, and custom products with an emphasis on nylons. Founded in central Illinois in 2007 by Jeff Goodwin and Ronda Haskell, the company grew rapidly and relocated to a brand new 43,000 square foot facility in Dyersville, Iowa in 2016.

JEDA originally set out to help smaller injection molders meet their materials challenges, and that same charter continues today; molders make up 100% of JEDA's business.

Growth and Expansion

After the new Dyersville facility was built in 2016, JEDA Polymers set out to expand their operations. "We already knew of ENTEK's reputation for building high-quality twin-screw extruders," said John Deeken, Engineering/Quality Management Administrator at JEDA. "While we had success using other extruder brands, we wanted to work with a USA-based supplier for several reasons, including faster delivery of spare parts. We also wanted to take advantage of the technical and processing expertise that we knew ENTEK provided."

At NPE2018 in Orlando, FL, Jeff Goodwin and Ronda Haskell visited ENTEK's booth and saw ENTEK's live demonstration of a 5-minute screw change on their QC^3-43mm twin-screw extruder. "They saw that the ENTEK QC machine features are better for operators, and makes their life easier," said John Deeken. "They also saw that the new 43mm machine was the perfect size for JEDA's needs for smaller lots of materials, and frequent color changes. After the show, we decided to make a trip to Oregon to meet with ENTEK's personnel and run trials in their Pilot Plant."

(continues on page 3)

A Message from Kim Medford, ENTEK's new President

Welcome to the latest issue of ***Extrusion Solutions***.

Kim Medford

> *"Because of you, our customers, and our outstanding team of employees, ENTEK is on a growth journey and the opportunities are great."*

An Introduction

Hello! In late August I was humbled and honored to be named the new President of ENTEK Manufacturing.

They say we stand on the shoulders of those who came before us and I am very fortunate that each of my predecessors provide me with broad shoulders, making an excellent foundation to continue to build ENTEK Manufacturing as the best supplier to its customers. With that in mind I'd like to thank ENTEK's CEO, Larry Keith, and ENTEK Manufacturing's former President, Dr. Kirk Hanawalt, for their support and guidance. For over a decade, I have had the opportunity to work with both Larry and Kirk, first as outside counsel for ENTEK Manufacturing, and since 2012 in the role of Vice President & General Counsel and as a member of the executive management team. They have been instrumental in mentoring me to hit the ground running in my new role.

Because of you, our customers, and our outstanding team of employees, ENTEK is on a growth journey and the opportunities are great. We have a lot of exciting things happening, and I look forward to leading the company into the future.

2020: A Year Like No Other

It's an understatement to say that 2020 has been a difficult year. Like everyone in our country and around the world, we've had to deal with the COVID-19 global pandemic, which has brought enormous challenges. Here in Oregon we were also faced with wildfires this fall that burned down a large part of our state and threatened the health and safety of our surrounding communities and our employees.

Despite these challenges, ENTEK stood strong with our employees, suppliers and customers and is ready for 2021 stronger than ever. While COVID is still very much a part of our daily lives, we have stringent safety measures in place and continue to conduct business as usual to meet our customers' needs. I am so proud of our teams for their resilience and commitment through the shifting challenges we faced during 2020.

In true ENTEK style, during the wildfire crisis, several of our employees volunteered at temporary shelters and food banks to help make sure that people displaced by the fires were cared for. As the need of our surrounding communities continues as people begin to take on the rebuilding process, our team continues to support this effort through several programs, including the ENTEK Employee Community Fund which provides new coats for kids in need in our local communities. Additionally, in about a week our teams will do what we do every year, which is to provide food boxes to the less fortunate in our community to ensure that they have a full meal to celebrate the Thanksgiving holiday.

In our last issue of *Extrusion Solutions,* Larry Keith said it best: 'ENTEK doesn't do things halfway.' We will continue to lead the way, in our community and in our industry.

In This Issue

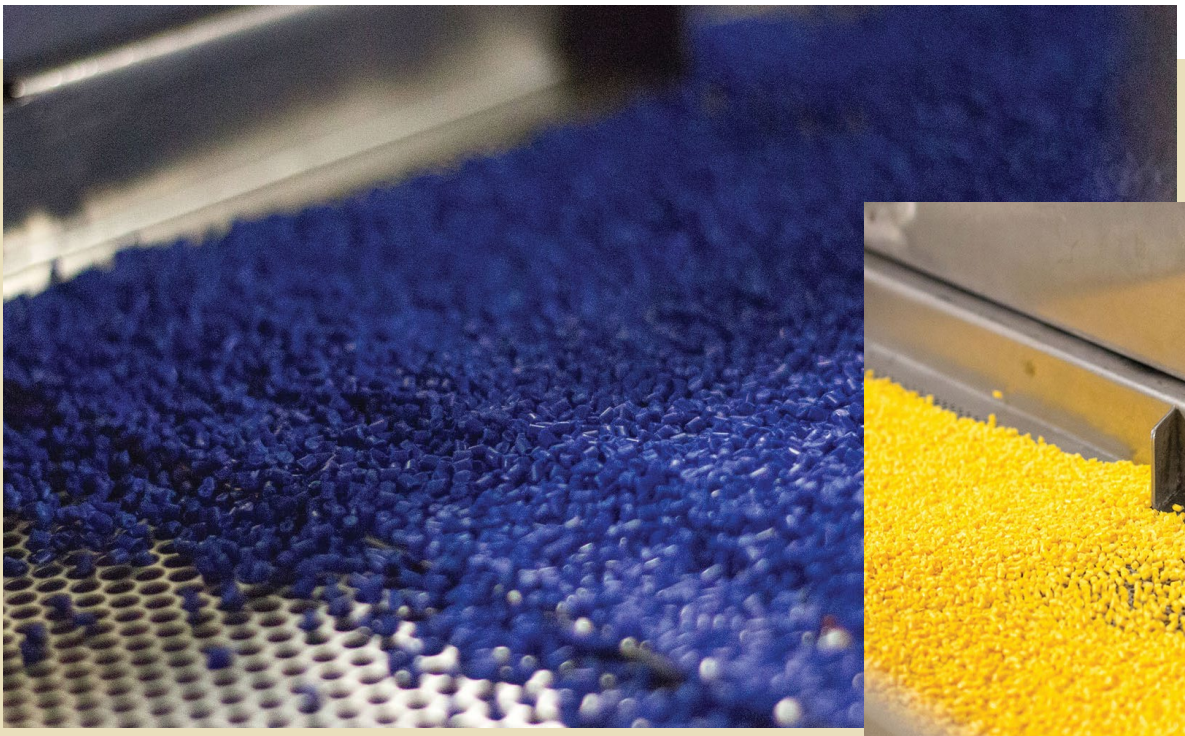
I hope you enjoy this issue of *Extrusion Solutions*, which features our cover story on our customer JEDA Polymers, and how ENTEK's technical processing expertise has helped them succeed; a feature on ENTEK's extruder rebuild services, and more.

Thank you to all of our customers for your continued support. I look forward to meeting many of you in the future. In the meantime, please stay safe and we wish you good health.

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

Sincerely,

Kim Medford
President



JEDA Polymers Chooses ENTEK

(continued from page 1)

Technical Challenges with Color Compounding

When compounding their materials, JEDA uses a unique, proprietary color process to make color changeovers faster, easier, and drive down their production costs. While JEDA's color process has advantages, it can also be challenging to process in a twin-screw extruder.

"We went to ENTEK looking to develop a stable process to run our proprietary formulation through the twin-screw extruder," said John Deeken. "It's important to find the best way – where, when, and how – to feed the formula into the machine."

When initial attempts didn't produce the desired results, ENTEK's Technical Processing Manager, Dean Elliott, came up with an idea for using ENTEK's new Vacuum Feed Technology (VFT) to optimize the process. It was discovered that VFT, which is designed for processing light fluffier materials, also worked well to pull out excess gas from JEDA's process.

"We were using this formulation with our other extruders, but we really improved the process with ENTEK's machinery/technology," said John Deeken. "Their processing expertise was and is extremely valuable to us."

Service, Service, Service

JEDA purchased and installed an ENTEK QC^3-43mm twin-screw extruder with VFT in 2019. While the machine meets or exceeds all their expectations, JEDA is most happy with ENTEK's customer service.

"Working with ENTEK is refreshing; their support team always follows up, and makes sure any and all issues are resolved," said John Deeken. "ENTEK's team provides impressive service and overall are a great technical partner; they want to ensure we are getting the most out of our machinery."

ENTEK Customer Support: **REBUILD SERVICES**

ENTEK is working to reduce cost of ownership for our customers by expanding our twin-screw extruder REBUILD, REFURBISHMENT and REPAIR SERVICES. Let us help you identify potential areas for improvement and schedule these services, which will save you time and money, and keep you up and running.

Barrels

We will work with each customer to evaluate your worn barrels, including coordination of the return, assessment of damage, needed repairs and potential for replacement of liners. In addition to cost savings over the lifespan of the barrels, rebuild services will save time, keeping your barrels working for you.

Gearbox Inspection & Rebuild – Extruder And Splitter Gearbox

Scheduled rebuilds of your gearbox prevent unplanned downtime, urgent failures and limit "fire drills" for your team. Let us help you create a plan, as part of your preventative maintenance routine. We will strive to have a rental gearbox available, as possible.

Melt Pumps

Complete rebuild and repair of your ENTEK melt pump is available on a scheduled or unplanned basis, following an evaluation and assessment by our technical staff. We will work with your team to assess your needs, including spares and a plan for preventative maintenance of your melt pump.

Contact us for more information by calling 541-259-1068 or email ENTEK_Customer_Support@entek.com

Understanding Vent Flow

Dean Elliott
Technical Processing Manager

Vent flow occurs when polymer and/or compound flow out of a vent opening preventing air/gases from escaping out of the extruder. Not only can vent flow cause product defects but it can create an undesirable mess and can sometimes be an operator's toughest challenge. It is highly recommended to use a wood or plastic tool to clear out a vent, using steel screw drivers/prybars or scrapers to clear out a vent opening can potentially cause a catastrophic failure when the metal tool is pulled into the extruder by the rotating screws.

The following situations describe when a vent is vulnerable to compound flow:

- When a vent is located near the exit of the extruder and the die or exit pressure is too high.
- When a vent is located upstream of and near a restrictive mixing element, for example, a reverse screw element or a neutral kneading block.
- When a formulation is altered during a production run and the compound viscosity is reduced.
- When the feed system is unstable, compound viscosity changes may occur.
- When starting the extruder, residual material in the extruder may act as a restriction along with typical start up instabilities and viscosity changes.
- When extruder torque suddenly rises significantly or is consistently high, this can be an indication that the fill level of the extruder is too high.
- When raising feeder throughput to the extruder without increasing the extruder screw speed, the fill level of the extruder increases.
- When using poorly designed or incorrectly installed vent inserts.

The following actions should be considered to minimize or mitigate vent flow:

- Increase extruder screw speed to reduce the fill level of the extruder and improve pumping efficacy.
- Lower feeder throughput to reduce the fill level of the extruder and reduce exit pressure.
- Replace worn screws and barrels located downstream of the vent to improve extruder pumping efficacy.
- Alter the pitch of the convey screw elements downstream of the vent and/or under the vent to one diameter pitch elements, in other words, for a 70mm diameter extruder the pitch would also need to be 70mm.
- If possible, increase the mesh size of filtration screens to reduce exit pressure.
- Increase the diameter of die holes and/or add more die holes to reduce exit pressure (die hole diameter has a more significant impact than number of die holes)
- For underwater pelletizing, purge out frozen die holes to reduce the exit pressure. Also, if possible, raise the temperature of the water to reduce exit pressure and minimize the risk of freezing die holes. During a formulation transition, consider diverting to purge to reduce exit pressure.
- Increase the temperature of the die and adaptors to reduce exit pressure.
- For a vacuum vent, if possible, lower the level of vacuum.
- If possible, alter the screw configuration and move restrictive mixing elements further downstream from a vent.
- If possible, monitor the vent during an initiated process change or as quickly as possible during an unexpected process change.
- The vent opening is located above the correct screw. It should be above the screw side that is rotating downward not the screw side that is rotating upward.
- The vent insert is bolted down evenly with equal torque applied to each bolt.
- Stabilize feeder/s by checking feeder settings, calibrations and sizing the feeder screw and tube correctly.
- Purge out residual material at start up. Start the extruder at higher than targeted screw speed and/or lower than targeted throughput. Monitor the vent during start up. Once stabilized, alter set points to targeted screw speed and throughput.

(continues on page 6)

We Are ENTEK

Understanding Vent Flow

(continued from page 5)

Blocked Vent

Open Vent

A clear or better understanding of what causes vent flow and when the extrusion system is vulnerable to vent flow could prevent or provide a rapid response to a vent flow situation. Running a lower vacuum to prevent vent flow may not always be an option. Installing a vent stuffer allows higher vacuum draw, vent stuffers act like a pump preventing the polymer/compound from escaping the extruder while allowing volatiles to escape.

Upcoming Events

We are hopeful that in-person conferences and shows will be taking place again in 2021. With that in mind, ENTEK is scheduled to exhibit at the following events. We hope to see you there!

Plastics Recycling Conference
May 3-5, 2021
Washington DC

NPE 2021
May 17 – 21, 2021
Orlando, FL
Booth W3981

NPE2021 The Plastics Show

Compounding World Expo
Nov. 3 – 4, 2021
Cleveland, OH

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