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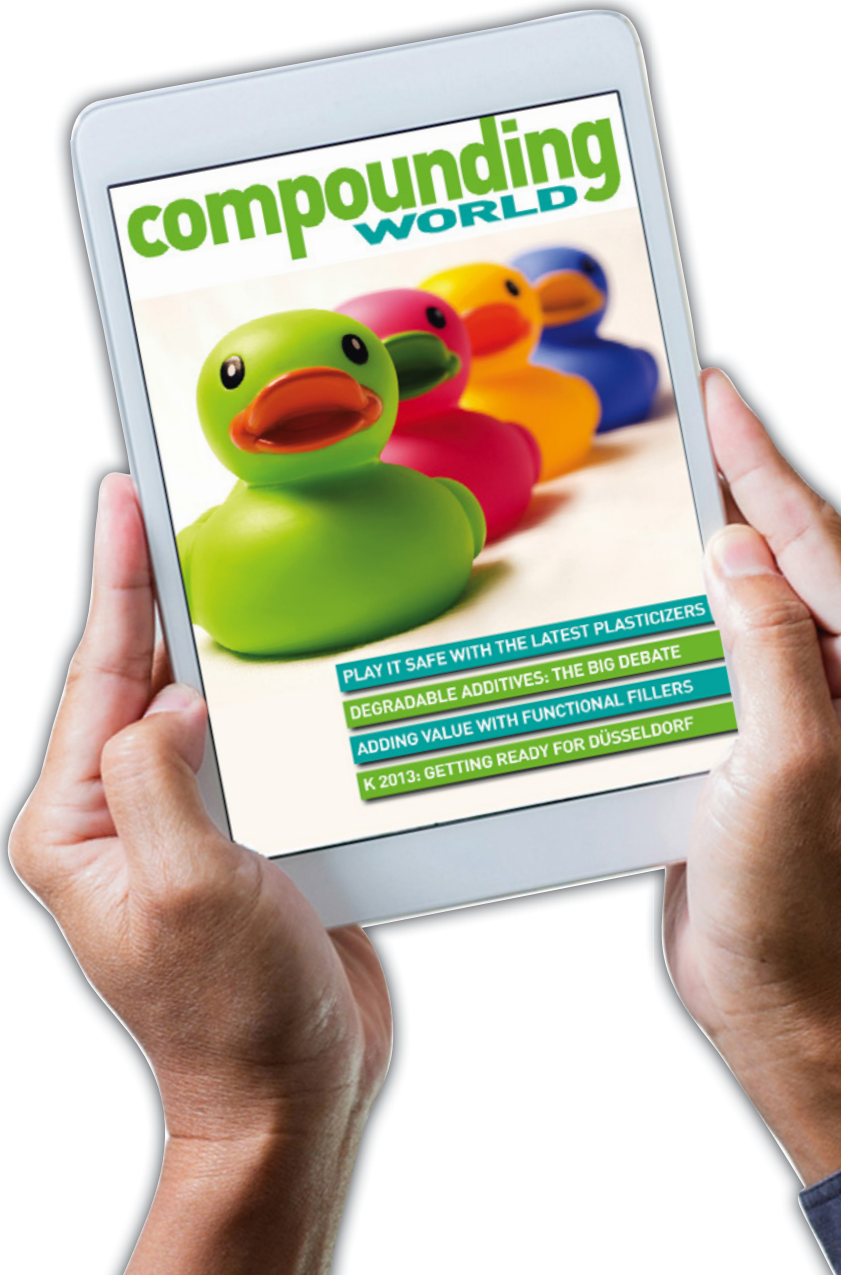

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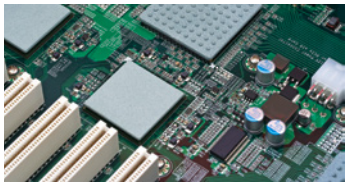
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* As compared to previous generation extruders of identical size

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ExxonMobil adding TPV capacity

ExxonMobil is to expand its speciality elastomers plant at Newport in the UK. Scheduled for completion in late 2017, the new investment will lead to a 25% increase in the firm's global capacity for the Santoprene brand of thermoplastic vulcanisates (TPVs).

Kurt Aerts, Speciality Elastomers and Butyl Rubber Vice President at ExxonMobil, said the planned TPV expansion "strengthens our leadership position and reflects our continuing commitment to help customers around the world manufacture high-performance products that require both flexibility and durability".

In addition to Newport, ExxonMobil makes Santoprene TPVs at a site in Pensacola, Florida, from Vistalon synthetic rubber produced at facilities in Louisiana in the US and France.

Santoprene TPV can be extruded, moulded or thermoformed. It is resilient, flexible and resistant to heat, fluids and chemical and offers lower density than thermoset rubbers and other TPEs, ExxonMobil claims. Applications range from healthcare devices to automotive components, including weather seals.

www.exxonmobilchemical.com

PolyOne buys composite firms

US-based polymer materials giant PolyOne has acquired Gordon Composites and Polystrand from Gordon Holdings in a combined $85.5m deal that will expand its capabilities in lightweight composite materials.

The acquisitions are expected to add $40m to Polyone's revenues and be accretive to earnings in 2017.

Gordon Composites is focused on high strength profiles and laminates made from thermoset composites for use in vertical and crossbow archery, sports and recreation equipment, prosthetics and office furniture systems. Polystrand makes reinforced thermoplastic composites for applications including aerospace, transportation, security and protection.

The two companies will form a new business called PolyOne Advanced Composites.

"We have immediately established PolyOne as a leading innovator and producer of continuous reinforced thermoplastic composite technology. We expect this technology to become a platform of the future for companies whose products demand strength and design flexibility," said Craig Nikrant, President of Speciality Engineered Materials at PolyOne.

www.polyone.com

Wipag's carbon compounds lift off

Wipag has announced that its second-use carbon-fibre-reinforced plastic (CRP) WIC PA6 30 has been used in a mass produced component for the first time – a stability fin for a kiteboard for leading producer North Kiteboarding.

While CRP has long been regarded as an attractive material because of its combination of stiffness and light weight, Wipag said its cost has limited its use in part manufacturing. It has been able to address this in its new carbon reinforced injection moulding grades by using secondary carbon fibres.

The fin will be presented at the company's stand at K2016 in Dusseldorf, Germany, in October.

www.wipag.de

Investment at Broadway Colours

Broadway Colours a masterbatch manufacturer based in Suffolk, UK, has followed up on the recent installation of a new grinder and extruder in its grinding facility with the addition of a twin-screw extrusion line and larger mixing unit.

The company said the new investment will enable it "to produce larger orders more efficiently, without compromising our market-leading quality and lead times".

Broadway Colours has nearly 40,000 colours in its archive and has updated its indexing system to include a second new spectrophotometer to go with the accelerated weather station and Xenon Arc tester in its laboratory.

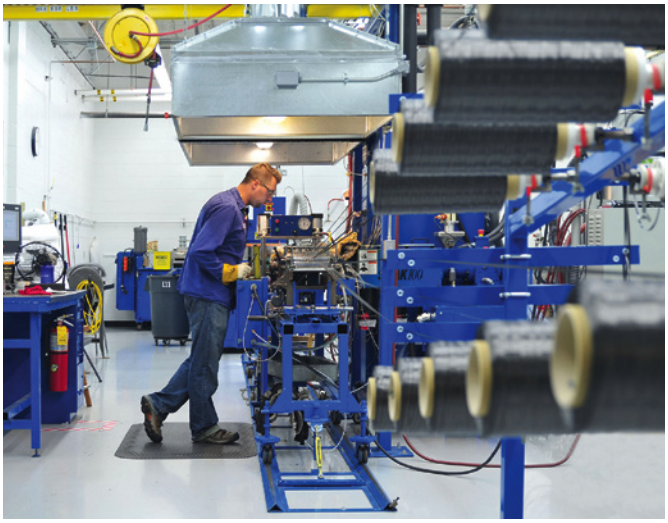
http://broadwaycolours.com

PlastiComp unveils new laboratory for LFT R&D

US-based PlastiComp, which specialises in long-fibre thermoplastic (LFT) materials and technologies, has recently completed a capital improvement project at its manufacturing and corporate headquarters facility at Winona, Minnesota, moving its R&D functions into a dedicated laboratory space.

The 'Da Vinci R&D Lab', as it has been dubbed, will provide an isolated environment for PlastiComp's smaller long-fibre composite pellet pultrusion line and auxiliary equipment for conducting evaluations of new raw material feedstocks and processing enhancements.

"Our many industry partners really like the plant-within-a-plant concept the new lab offers because it provides a secure environment for our Technical Development Centre activities in which we can conduct confidential trials



separate from our primary production operations," said Eric Wollan, Vice-President of Technology and Business Development. "Plus, it has opened up valuable floor space for future expansion that will allow PlastiComp to quickly add more composite pellet pultrusion lines as our business continues to grow."

The firm's Complet range of composite pellet products incorporate long glass, carbon and speciality fibres into polymers ranging from PP to PEEK. These are formed into finished components via injection moulding or profile extrusion processing methods. Applications include transportation, aerospace, defence, sports goods, industrial equipment and consumer goods.

www.plasticomp.com

Laser welding partnership

Americhem has announced a collaboration with laser welding specialist LPKF Laser & Electronics to supply a full materials and equipment solution.

Laser welding requires a transmissive upper plastic component and an absorbing lower part, allowing the laser light to pass through the top part to heat the material at the interface. The lower layer is often based on highly absorptive pigments such as carbon black. The technology is gaining use in the automotive, medical and consumer products industries.

Within the new partnership, LPKF supplies the production equipment and process solutions; Americhem provides colouring technology for the upper and lower material layers.

www.americhem.com

www.lpkf.com

Star Plastics opens second plant in China

Star Plastics, a privately-owned US compounder of engineering grade thermoplastics, has opened a second plant in China to address growing demand from the local market.

Based in Shandong province south of Beijing, Star Plastics Shandong (SPS) complements the company's existing operation in Shanghai. Combined, the two locations employ about 50 people.

The new SPS site covers 7,000m^2 of production space and includes a full-service lab. A 68mm Nanjing Giant twin-screw compounding line is in operation for start-up and space is available for nine more compounding lines if future demand growth warrants. Star Plastics said that it "facilitates the company's role as a global supplier to the growing demands of the plastics market, and allows continuous improvements in service to its customers".

SPS will make the company's StarPrime brand materials in polymers including PC, PC/ABS, ABS, PC/PBT, PC/PMMA, PC/ABS/PMMA, PC/ASA, ABS/PMMA, ABS/PBT, PPO and HIPS with fillers such as glass fibre, steel fibre, carbon fibre, minerals and flame retardants. The new facility will also make the company's EcoTech Polymers containing post-consumer recycled content.

The company said it will be targeting key end use markets including electrical and electronics, lighting, 3D printing, automotive, medical, lawn and garden, telecoms and safety equipment sectors.

Star Plastics offers custom colour compounding, tolling and material trading services. It has two sites in the US, located at Ravenswood and Millwood in West Virginia.

www.starplastics.com

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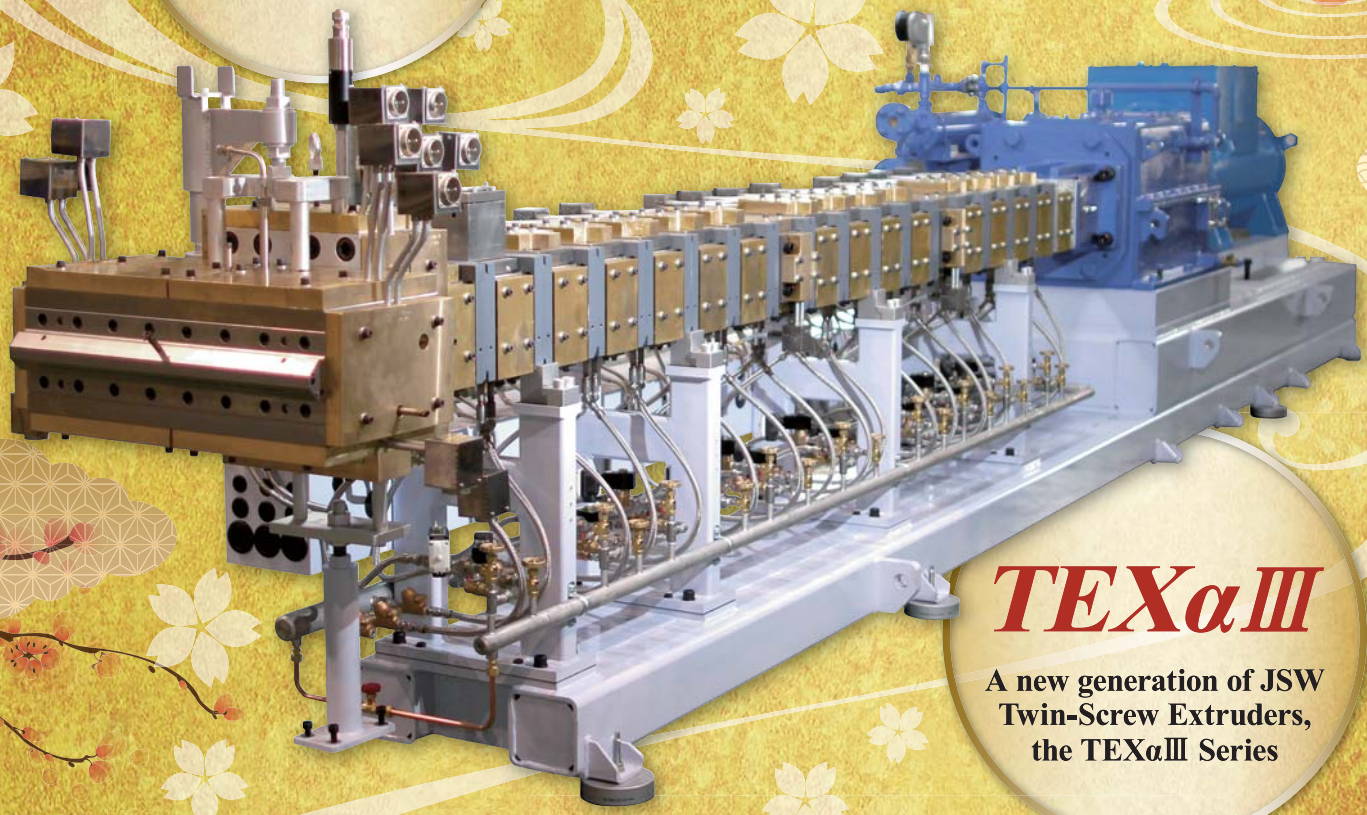

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Infinity launches ETPs for aircraft

Americhem group company Infinity LTL Engineered Compounds has launched a new specialty line of engineering plastics compounds for aircraft interior applications offering full compliance with the sector's main flame, smoke and toxicity standards.

The new products comply with FWW regulations FAR 25.853a and FAR 25.853d for flammability. They also meet OSU heat resistance requirements covering peak and total heat release rates, as well as aviation industry limits on smoke density and toxic gas emissions.

PHOTO: NADEZDA MURMAKOVA / SHUTTERSTOCK.COM

The new products include the Instruc family of structurally reinforced compounds and ColorFast line of precoloured resins. The latter includes ColorFast SFT2000, a new aviation industry compliant PC alloy suitable for injection moulding and extrusion processing.

The product range includes ABS, PA, PC, PC/ABS. PPSU and PEEK compounds, as well as TPU. Applications include aircraft interior parts such as cabin trim, storage compartments, arm and foot rests, video bezels and partitions.

"These products, like all products from Infinity LTL, are available around the globe with no minimum order quantity, short lead times and complete product support," said Infinity LTL Business Manager Don Hone.

www.ltlcolor.com

Borealis acquires recycler

Borealis has agreed to acquire MTM Plastics and MTM Compact, subject to regulatory approval. Terms were not disclosed.

Based at Niedergebra, Germany, MTM is described as a technology leader in the recycling of mixed post-consumer plastic waste and one of Europe's largest producers of post-consumer polyolefin recyclates.

Borealis said in a statement that the acquisition "reflects our proactive and dedicated 'keep discovering' approach to provide specific and innovative solutions in tackling core global challenges".

www.borealisgroup.com

DuPont inaugurates China plant

DuPont Performance Materials (DPM) has officially inaugurated its engineering plastics compounding plant at Guangming New District at Shenzhen in China's Guangdong province.

This new facility supplies multiple DuPont products - notably Zytel PA, Crastin PBT and Delrin POM resins plus Bynel adhesive resins and Fusabond resins - for the automotive, industrial, consumer and packaging markets in China and the wider Asia-Pacific region.

According to DPM, the new facility is the largest in its global network and is designed for future expansion. Key features include an enhanced level of automation from silo to extruder and in packaging.

The company said the compounding equipment has been designed "to create a production setup that allows faster transitions between different product families".

http://plastics.dupont.com

EC to investigate formaldehyde

The European Commission (EC) has requested the European Chemicals Agency (ECHA) to investigate formaldehyde releasers and their uses in the EU.

The stated aim of the move is to support the Commission in deciding whether to request ECHA to prepare an Annex XV dossier for restriction on formaldehyde and whether formaldehyde releasers should be part of such a dossier.

Interested parties are being requested to submit any information related to formaldehyde releasers by 4 October 2016.

The process allows interested parties to express views and concerns in the preparatory phase. They may also comment on the different documents under preparation in ECHA in relation to restrictions, such as reports on substances in articles and guidelines on restriction entries. This is not part of the normal public consultation process on restriction proposals developed by EU Member States or ECHA.

http://echa.europa.eu

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Conductive Plastics set for US

Places are booking up for AMI's first Conductive Plastics conference in North America, which takes place in Philadelphia on 27-28 September.

The two-day event, which is supported by *Compounding World*'s sister magazine *Injection World*, looks at the development, processing and application of electrically and thermally conductive thermoplastic compounds for use in areas as diverse as fuel cells and batteries to LED lighting and thermal heat sinks.

The programme includes expert speakers from many of the established players in this market, including Premix, Imerys, HPF, RTP, LehVoss and PolyOne. It also includes some new names with innovative conductive offerings, including CarbonX, Mackinac Group, Ocsial Group and Aplied Nanostructured Solutions. Application expertise will be provided by ZBT, Integral Technologies and Outlast Technologies.

Delegates already booked to attend the event are drawn from a wide range of industry sectors and include representatives from Amphenol FCI, Enersys, Epcos-TDK, Forbo Group, Pentair, Rockwell Automation and SC Johnson.

To find out more about the conference, or to book a place, contact AMI North America's Senior Conference Coordinator Kelly DeFino Tel: +1 610 478 0800; Email: **KC@amiplastics-na.com**. Full details can also be downloaded from the conference **website**.

Plastic Resins adopts X-Rite technology

X-Rite, the Swiss-based specialist in colour science and technology that owns Pantone, has announced that US firm Plastic Resins has standardised on X-Rite colour management systems for all colour formulation and tasks.

Plastic Resins focuses its business on the development of small-lot custom colour concentrates. By using the X-Rite Ci7800 benchtop spectrophotometer with Colour iMatch software, X-Rite said the company "is able to easily measure samples and

quickly generate accurate colour recipes" based on parameters such as colour difference, metamerism, opacity, lowest cost or number of colourants in a formula.

According to Plastic Resins CEO Paul Warnell, the new equipment and software enables it to create colour formulations and to adjust if a batch is slightly off spec. "If we are building a formulation for a custom colour, Colour iMatch gets us 99% of the way there with accurate recipes and guides us to making proper colour adjustments for each lot. If we are matching a colour to the Pantone Matching System, Colour iMatch provides us the closest possible match."

www.plasticresinsinc.com
www.xrite.com

Emery opens new apps lab

Natural chemicals giant Emery Oleochemicals has opened an application laboratory for its Green Polymer Additives business within the new 6,770m² technical development centre (TDC) at its site in Cincinnati, Ohio.

The new facility will feature application testing for regional customers, mirroring those at the company's site at Loxstedt, Germany, which opened in 2013. Key features include: custom lubricant and plasticiser development, scale-up of Loxiol brand ester lubricants and Edenol plasticisers; formulation and applications testing for rigid and flexible PVC and engineered resins.

"Our lab housed in the TDC in Cincinnati is specifically designed to leverage our in-depth application knowledge of polymer processes and technical capabilities to deliver customisable market-ready solutions to the North American Market," said Dr Harald Klein, Global Business Director of the Green Polymer Additives business.

www.emeryoleo.com

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BASF's Senior Vice President, Global Pigments Alexander Haunschild launched the company's new branding

BASF rebrands its pigments business

BASF has launched a global rebranding of its pigments business under the new Colors & Effects name. The move has been accompanied by the creation of an industry-focused structure targeting plastics, coatings, printing, cosmetics and agriculture sectors.

"In this competitive marketplace, we created a brand focused entirely on pigments to provide our customers with products and solutions from one single source," said Alexander Haunschild, Senior Vice President, Global Pigments Business. "This brand underlies the key strengths we bring to the market: chemical expertise and a broad portfolio of colorants and high performance effect pigments."

BASF operates 13 pigment production sites in China, France, Germany, Korea, the Netherlands, Switzerland, and the US.

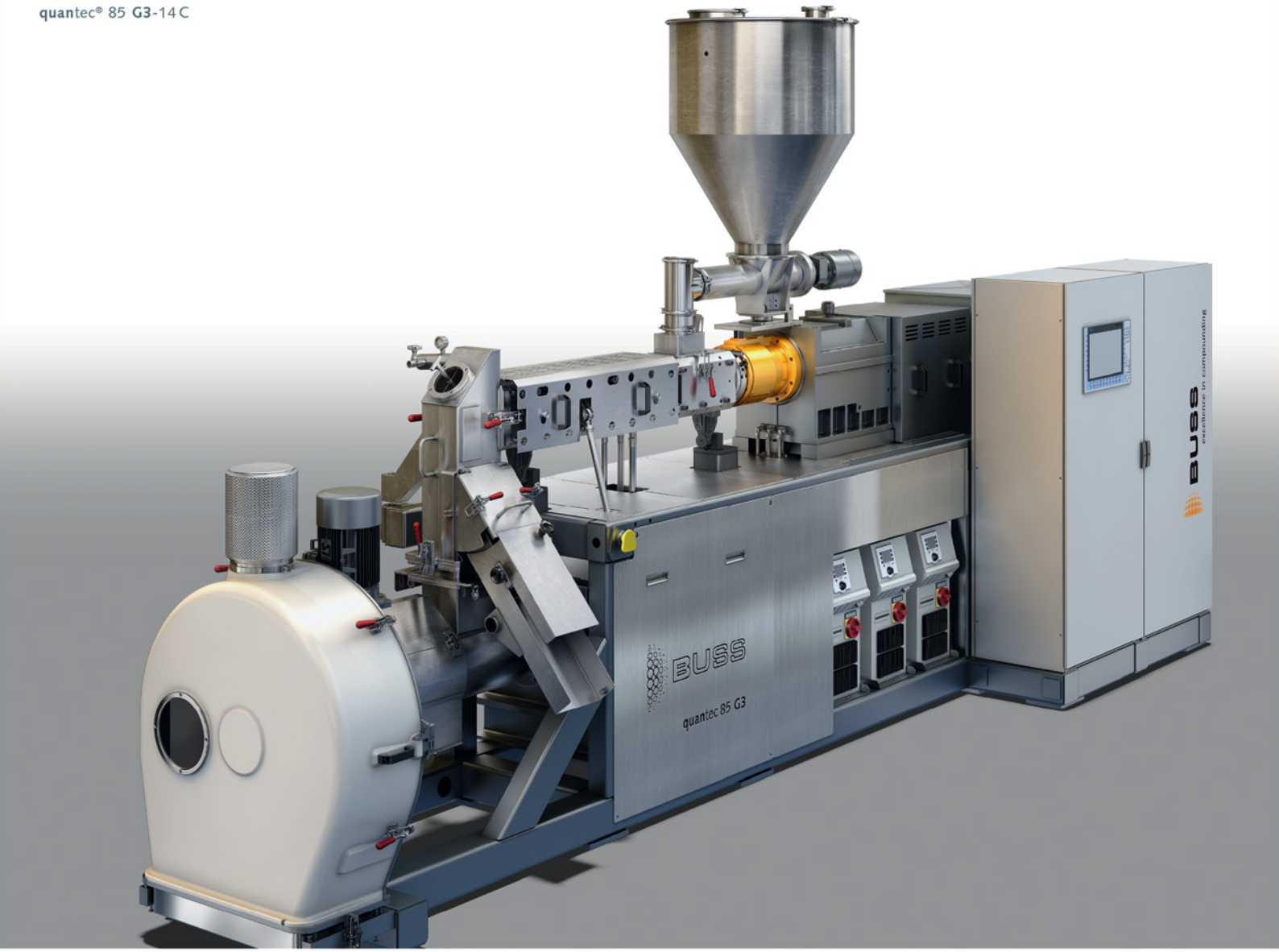
www.colors-effects.basf.com

Open house for Maag

Maag, which makes gear pumps, pelletising systems, filtration systems and pulverisers, said close to 100 processors, end users and guests attended the first open house at its sales and service centre in Thailand's Chonburi province.

The event was held on 30 June jointly with Maag's recently acquired subsidiaries Gala and Reduction Engineering Scheer. "There was great interest in the expanded service capabilities of the sales and service centre with the recent addition of rotor sharpening services, overhaul of underwater die plates, and the cleaning of polymer-contaminated machine parts," said Thomas Willemsen, Vice-President of Business Development for Aftersales and Service Centres at the Swiss firm.

www.maag.com



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Fillers get functional

PHOTO: MINERAL TECHNOLOGIES

Fillers for plastics are now providing added-value functions in compounds that are leading to some innovative new materials and applications. **Mark Holmes** looks at recent developments

For producers of polymer compounds, the most basic purpose of a filler is to increase bulk at low cost. However, this is no longer sufficient in the modern plastics industry. Fillers are increasingly required to fulfil other added-value functions, such as enhancing mechanical properties, UV or heat stability, thermal or electrical conductivity, dimensional stability, and flame retardancy. In doing so, they must not hinder or complicate the compounding process. This can mean the development and use of special treatment processes – not all fillers display intrinsic properties that can benefit plastic compounds.

Many of the newest developments in filler technology for plastics compounds are being driven by the need for lightweighting, particularly in automotive plastics, and for reducing carbon footprint, according to Patrick Wernett, Director – Performance Minerals R&D and Quality Assurance at **Minerals Technologies Inc**. "Technical trends include the replacement of metals with filled plastics materials and replacement of high density engineering resins with lower density resins like polypropylene and TPOs," he says. "This necessitates performance enhancement of the polypropylene resin with high efficiency reinforcing minerals. Selecting the appropriate fillers can improve impact resistance, flexural modulus (stiffness) and maintain ductility at low temperatures. Particle size, shape, aspect ratio and surface treatment are all critical to the performance of functional filler modified compounds."

Wernett explains that Specialty Minerals - a division of Minerals Technologies - works with compounders to optimise product selection and final part performance. "Our range of functional filler products includes talc, precipitated calcium carbonate, and ground calcium carbonate with a variety of particle sizes, distributions, and coating options. A number of new filler technologies have been introduced in recent years, but none have proven sufficient at providing performance benefits in plastics to offset the significantly higher cost compared to current state-of-the-art talc and calcium carbonate materials. Our new product development

Main image: Particle size, shape, aspect ratio and surface treatment are critical in development of functional calcium carbonate fillers

Right: Inside the Minerals Technologies's production facility at Lucerne Valley

process reviews these technologies as well as seeking to improve current mineral performance," he says.

"Current compounding equipment needs to provide adequate dispersion of the functional fillers to optimise their reinforcing and processing benefits in a polymer matrix," says Wernett. "Functional filler selection can significantly impact die scrub, wear on machinery, and throughput through improving the thermal conductivity of the mineral-polymer composite. Working with a supplier that has applications knowledge and expertise in plastics can offer compounders significant value in selecting the optimal mineral products for final part performance and meeting the processing equipment needs."

Specialty Minerals offers a range of filler products customised to meet specific challenges in the plastics compounding industry. "We are currently working on higher efficiency fillers for lightweighting, balancing property improvement and loading to optimise end use applications," Wernett says. "We continue to seek improved functional fillers that enhance physical properties and compound stability."

Hematite – a new filler

Manufacturer and supplier of minerals, fillers and extenders **Kish Company** is introducing a number of new products for the plastics industry, including an iron oxide filler. The company has just completed the first milling of the DenzFlex product. "Currently, the only iron oxide available on the market is magnetite," says Dr Chris DeArmitt at the company. "DenzFlex is manufactured from hematite, which offers the same density and hardness as magnetite but is a totally different mineral with different properties. It has the same density as magnetite – 5.2g/cm^3 – but almost double the thermal conductivity at 12.5W/cm/K. So while it can also be used for applications requiring density, such as sound damping and radiation shielding, it is also microwaveable. We see new applications for this filler in plastics for microwave heating."

Below: Mining talc at Mineral Technologies' Barretts operation

Hematite is a naturally occurring iron oxide mined from many deposits worldwide. Although primarily used to make iron and steel, the properties of hematite make it suitable for other applications, including as a filler for plastics. While hematite is common, it has not been used as a filler before because an extremely pure material is needed. It shares several features with magnetite, but DeArmitt believes that hematite filler may well prove to be a more cost-effective option in certain parts of the world.

Hematite filler can be used to add mass in various plastics, such as polypropylene, polyamides and polyethylene. Weight can be useful to impart a high quality feeling to a material or for sound damping. Loadings of 80wt% can be achieved giving compound densities of around 3.0 g/cm^3. Hematite can also be used as pigment where it can impart an attractive grey metallic sparkle. It also has both magnetic and electrical properties, while its high density makes it x-ray opaque. Hematite filler can be employed to make plastics detectable, for use in medical applications, food processing and for anti-counterfeiting.

Hematite can also be added to polymers to allow them to be heated either by microwaves or using induction. Typically, plastics are microwave transparent and, because they are electrical insulators without any magnetic properties, do not heat by induction. Hematite heats up very quickly in a microwave oven, approximately 200°C per minute in a standard domestic oven. While the pure material heats extremely quickly in a microwave, when used as a filler in a plastic this heating capability can be tuned to what is required, according to DeArmitt. There are applications requiring heat transfer where hematite's high heat conductivity could make it an attractive, low cost, speciality filler option.

Kish Company has also developed a low moisture talc filler. "When you mill talc and it is exposed to the air, it picks up water," explains Dr DeArmitt. "We have been

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Steer cuts shear to protect effect fillers

Steer claims its Omega system reduces damage when processing fragile fillers such as mica

India-based machinery maker Steer Engineering has developed its Omega twin screw compounding extruder with a new screw configuration designed for incorporation of special effect pigments, such as mica, with minimal damage to the fragile platelet structure. It claims up to 80% of particle size is retained in the final compounded product.

"The demand for performance and special effect pigments is seeing a dramatic rise, driven by developed markets and the emerging economies like China and India," says Steer Engineering CEO Atanu Maity. "The Omega platform is configured to process mica-based pigments with minimum damage to the platelet structure. It not only provides greater product appearance but effectively eliminates issues related to quality of properties, adaptability and damage."

Coated mica crystalline platelets are used as effect pigments in thermoplastics to create a pearlescent lustre or glitter-like appearance. However, the platelet structure is extremely sensitive to shear in the melt and even small alterations or changes in size can have a dramatic impact on coloration and appearance of the final compound.

The Omega Platform's special mixing elements are designed to eliminate shear peaks and, by maintaining a barrel to screw gap and screw to screw gap of less than 0.25mm, Steer claims it is able to achieve a full wiping, rather than shearing, effect. This addresses the issue of leakage, the company says. In addition, a deeper root depth of 1.71 draws more of the resin into the low shear screw root region and away from the high shear – and potentially damaging - barrel wall. This is also said to help prevent stagnation and reduce risk of degradation.

"Omega allows manufacturers to create brilliant effect pigment masterbatches. The production trials conducted at our Application Development Center in Bengaluru have given us phenomenal results," says Rob Roden, AVP and Global Head, Continuous Manufacturing Technology at the company. He says Omega allows producers to capture the full value and elegance of the special effect pigment.

www.steerworld.com

able to manufacture and package a product with a moisture level of 0.1-0.2%, compared with a normal 0.4%. This means that the talc can be used in hydrolytically unstable polymers, such as PLA, polyesters and polyamides, and we believe has much wider potential. We have also introduced a super fine talc – SF310 - for use as a nucleating agent, primarily in polypropylenes. Kish is able to mill the product to an extremely fine level and we are seeing great interest in this product at present."

Sphere One – a Kish subsidiary – has also launched a new product in its Extendosphere ceramic bead range, widely used for lightweighting applications in plastics. Manufactured from a new source mineral with a higher alumina content, the spheres are white rather than the usual grey, which the company believes will increase their appeal in the industry. They are claimed to be particularly strong compared with other spheres. They are available in hollow (Reluminasphere) and solid (Solosphere) versions.

Improvements in compounding

Industrial minerals group **LKAB Minerals** has been involved with compounding machinery manufacturer **Leistritz Extrusionstechnik** in a collaborative venture to improve the processing of its hydromagnesite huntite filler material. LKAB Minerals has developed UltraCarb LH3C – a coated, very fine and pure hydromagnesite huntite with high hydromagnesite content. Both hydromagnesite and huntite have intrinsic flame retardant properties. However, in combination they can offer specific properties that can be adjusted through selected mining and processing to meet a number of applications.

"We are seeing a huge interest in replacing synthetic energy consuming fillers with more sustainable mineral fillers," says Stefan Viering, research and development engineer Polymers at LKAB Minerals. UltraCarb is used in a range of polymers such as polyethylene, polypropylene and PVC. However, in order to maximise the benefits in these resins, the company needed to address

PHOTO: MINERAL TECHNOLOGIES

Lightweighting of automotive parts is a key driver in functional filler development

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Right: LKAB Minerals' UltraCarb hydromagnesite huntite in rock and powder form

some key compounding issues. It was this need that led to the project with Leistritz.

"Fillers are becoming more and more functional," says Michael Thummert, head of Corporate Communications at Leistritz. "New coatings and other surface chemistries are a tremendous advantage for final applications and further facilitate higher filling levels."

Viering explains that he sees two main technical trends at present – high quality fillers with greater functionality along with improved polymers able to incorporate an increased filler content. "We believe that providing functional fillers with metallic characteristics and anisotropy for better utilisation of the polymer filled volumes is becoming very important," he says. "For example, hydromagesite huntite is an efficient halogen-free flame retardant filler, which provides good endothermic fire retardancy and char formation. However, it does require compounding and conversion processes that are well adjusted. High filler content requires stable, high volumetric dosing. It is also often observed that die heads are not particularly well designed to handle highly filled compounds."

Thummert says that the key concept for good incorporation of a high degree of fillers in the polymer matrix is volume. "The more volume the machinery provides, the easier the handling will be. If this is combined with compounding equipment providing high torque levels, then this is extremely helpful in processing highly viscous materials. High filler content also means a lot of air is inserted in the process, which makes venting and degassing a challenging task for processors. This means that the screw geometries have to be adapted to this task, in addition to the high dispersion needs of the highly filled compound formulations. In particular, in order to meet the compounding requirements of UltraCarb LH3C, the improved design of the side feeders in terms of functionality with segmented screws, high volume and better handling was extremely helpful," he says.

Below: Compounds incorporating LKAB's UltraCarb filler are used in wire and cable applications

Surface treatments

New treatment technologies are also being developed that allow existing fillers to deliver improved functionality. One company working in this area is **Hybrid Plastics** – the developer of POSS additives. "The trend is for multifunctional fillers that, in addition to providing filler effects such as reinforcement, adding volume and providing cost reductions, can also provide other enhancements including dispersion, fire retardancy, clarity and anti-scratch effects," says Joe Lichtenhan, the company's President. "Multifunctionality can simplify formulations, reduce formulation SKU count, and provide differentiation in the market place."

Hybrid Plastics says that POSS – Polyhedral Oligomeric Silsesquioxane – is a nanostructured product that bridges the gap between ceramic and organic materials. POSS can improve product performance without sacrificing mechanical properties and is used in a range of industries. The company adds that POSS technology is derived from a continually evolving class of compounds closely related to silicones through both composition and a shared system of nomenclature.

POSS chemical technology has two specific features. Firstly, a chemical composition that is a hybrid, intermediate ($RSiO_{1.5}$) between that of silica (SiO_2) and silicone (R_2SiO). Secondly, POSS molecules are physically large with respect to polymer dimensions and nearly equivalent in size to most polymer segments and coils.

"POSS silanols - SO1458, SO1450 and SO1455 - are our primary surface treatment products," explains Lichtenhan. "For thermoplastics, the POSS is compounded into a resin at the feeder throat with pellets, while the filler is b-staged. However, for pre-treatment of powders POSS is dissolved in solvent and/or sprayed onto powders and tumble mixed. Silanols are chemically unique and a bit rare, but POSS silanols are chemically stable. Silanols react to surfaces in a similar fashion to coupling agents. The POSS silanols bind to polar surfaces of powders or key ingredients and ultimately form a Si-O-Metal bond on the surface. No ethanol, methanol or acetate is eliminated, with the

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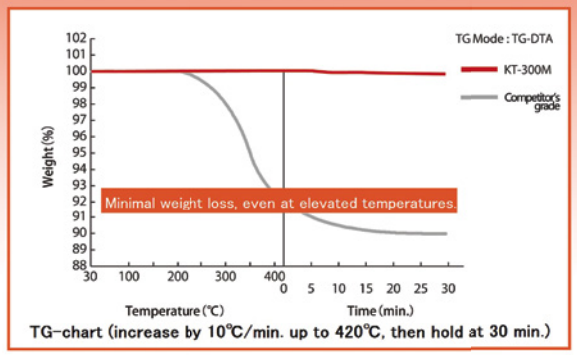

TG-chart (increase by 10℃/min. up to 420℃, then hold at 30 min.)

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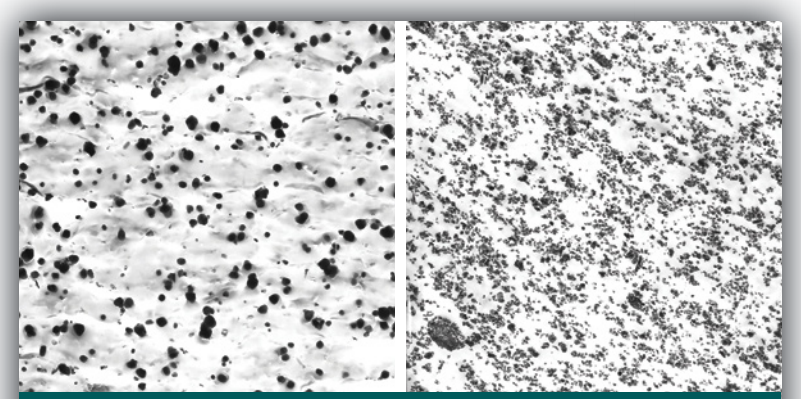

POSS technology from Hybrid Plastics is claimed to provide finer particle size and more uniform dispersion leading to brighter white and improved gloss. Left: PEEK with 40 w% TiO_2 dispersion and coupling agent. Right: PEEK with 40wt% TiO_2 dispersion with POSS

reaction from Si-O-H to Si-O-M being thermodynamically driven which is favourable."

Hybrid Plastics says that a wide range of fillers, such as metals, metal oxides, minerals, colourants, pigments and key ingredients containing polar groups, are suitable for treatment with POSS. Amine functional POSS – AM0265 and AM0281 – are claimed to be effective for carbon-based fillers. "Improvements with POSS include a more effective use of the filler at lower loadings. This applies to reinforcing fillers and colorant. Hence, savings are realised by using less filler through the dispersion of the filler with POSS. It can also aid gloss and colour intensity," Lichtenhan adds. "Most customers also see a decrease in viscosity through the use of POSS dispersion agents. Filler loading and viscosity increases nearly always go hand in hand. The use of POSS often breaks this paradigm. These improvements can be achieved because POSS forms cages that control the surface area and volume around particles. This affords enhanced dispersion, viscosity reduction at high filler loadings and more effective use of filler. Dispersion of fillers through the use of surface area and volume modification additives like POSS is new."

Hybrid Plastics highlights a number of new capabilities for fillers using POSS additives. "Traditional coupling agents and surfactants do not control the surface area around a particle. They do provide a more compatible interface. POSS cages do not polymerise on the particle surface and the cages are rigid and contain compatibilising organic groups. These cages dominate the surface area of the particle because they are rigid and around 1.5nm in diameter. Similarly, volume control around a particle is critical to controlling the viscosity of high solids and suspension stability. POSS cages provide volume around the particle and this allows flow and movement of the particles by each other resulting in lower viscosity. Similar viscosity reductions can be achieved by spherical particles, but it is more expensive to manufacture these. POSS can also bridge the gap between inorganic and organic materials. The hybrid organic-inorganic composition of POSS provides a mechanical inter-phase transition between a rigid/hard inorganic filler and the softer organic resin material."

As an example of what is possible with POSS, Hybrid Plastics has been working with **The Resin Enterprise Inc.** on a new application in filled Temppeclear compounds. "We are adding flame retardants, glass fibre, carbon fibre, PTFE and impact modifiers in various combinations and/or singularly to a base resin of polyphenylene ether (PPE)," says Linda Marlin, President of The Resin Enterprise. "The addition of POSS has improved the material's processing, physical properties and colour. This material can now compete in the market place with Radel products, as well as polysulfone and PEI. Right now the industry is starved for alternatives to PEI and polysulfone because of a market shortage of these materials. PPE is normally alloyed with polystyrene which makes the base resin processable, but it also reduces some of its high temperature and chemical resistance capabilities. With the deletion of the polystyrene and the addition of POSS, many new opportunities for Temppeclear are emerging. The addition of POSS to PPE also enables the resin to become amber clear and we are continuing to develop methods to improve the translucency of this material to a window clear tint. Some of the markets we are working on include automotive, laboratory, food products and plumbing.

Click on the links for more information:

- **www.mineralstech.com**
- **www.kishcompany.com**
- **www.sphereone.net**
- **www.lkabminerals.com**
- **www.leistritz.com**
- **www.hybridplastics.com**
- **www.resinenterprise.com**

Right: POSS treated PPE polymer developed by Resin Enterprise for improved filled performance

Turn page for the full programme ➤

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AMI and Compounding World magazine are pleased to announce the Compounding World Asia 2016 conference, which will take place on 22-23 September 2016 at the Grand Copthorne Waterfront Hotel in Singapore.

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The conference will cover business strategies and new materials technologies, as well as providing practical advice on getting the most from compounding lines.

Its primary focus will be on the production of technical compounds based on engineering thermoplastics, thermoplastic elastomers and performance polyolefins for demanding applications in markets such as the automotive, electrical/electronic, medical and industrial sectors.

Dedicated sessions will focus on the latest additives and formulations for adding value and new functionality to thermoplastics. In addition, there will be analysis of key market trends in the compounding industry, plus discussions on how to grow business in an increasingly competitive global arena. Experts will also cover new developments in processing technology and provide tips on how to optimize compounding operations.

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Delegate registration

Gain a competitive advantage from the insight and information provided by the high-level conference program. Networking breaks will give you a chance to further develop your business contacts, while the focused exhibition will provide a chance to catch up on the latest developments from leading suppliers.

For companies wishing to register two or more delegates, group discounts may be available. Please contact the Conference Organiser for more details.

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2. **Discover new additive and materials technologies for adding value to compounds**
3. **Learn practical tips for getting the most from compounding lines**
4. **Gain insights into global industry trends, successful business strategies, and growth opportunities in Asia's most dynamic markets**
5. **Network with other professionals from the plastics compounding supply chain**

Turn page for booking details ➤

COMPOUNDING WORLD ASIA 2016

Thursday 22nd September 2016

09.00 Registration and welcome coffee
10.00 Opening announcements

SESSION 1 - EXPLORING MARKET OPPORTUNITIES AND STRATEGIES FOR SUCCESS

10.10 **Analyzing trends in the global plastics market and the growing importance Asia's compounding industry**
Mr. John Nash, Head of Strategic Research,
AMI CONSULTING, United Kingdom

10.40 **PANEL DISCUSSION: Exploring opportunities and strategies for growing a profitable compounding business in Asia**

Mr. Derek R. Bristow, Senior Vice President and General Manager, Asia Pacific,
A. SCHULMAN Inc., Hong Kong

More panellists to be announced

11.40-12.10 Morning coffee sponsored by: coperion confidence through partnership

SESSION 2 - ADDING FUNCTIONALITY AND VALUE TO THERMOPLASTICS

12.10 **Inherently dissipative polymers (IDP) in plastics for static control applications**
Mr. Jukka Hillberg, CTO,
IonPhasE OY, Finland

12.40 **Mineral fillers for increasing the thermal conductivity of plastic materials**
Mr. Péter Sebö, Market Development Manager,
QUARZWERKE GmbH, Germany

13.10 **A new methodology for the systematic assessment of flame retardants**
Dr. Daisy Li, Technical Manager,
ICL, China

13.40-15.00 Lunch

SESSION 3 - DEVELOPING COMPOUND FORMULATIONS FOR NEW MARKETS AND APPLICATIONS

15.00 **New high-temperature compound materials for molded interconnect devices (MIDs)**
Dr. Oliver Frey, Head of Compounding Department,
ENSINGER GmbH, Germany

15.30 **Developing high-performance compounds and alloys for automotive applications**
Dr. Rajeev Basargekar, Technical Director,
APPL INDUSTRIES LIMITED, India

16.00 **Using BioPBS to improve the service temperature and impact strength of bioplastics compounds**
Mr. Ryuichiro Sugimoto, President,
PTT MCC BIOCHEM, Thailand

16.30-17.00 Afternoon tea sponsored by: SONGWON

SESSION 4 - OPTIMIZING THE FORMULATION AND PRODUCTION OF REINFORCED COMPOUNDS

17.00 **Unlocking the potential of natural fiber reinforcement for compounders**
Mr. Jeremy Warnes, Business Development Manager,
SCION, New Zealand

17.30 **Analyzing the effect of different fiber loadings in carbon-fiber-reinforced polypropylene compounds**
Mr. Philip F. Chu, Lead Chemist,
ZOLTEK/TORAY, United States

18.00 **Producing medium-length-fiber-reinforced polypropylene (MLFR-PP) compounds for automotive parts, including process, benefits and drivers for change**
Mr. P B Raman, Advisor,
STEER ENGINEERING Pvt. Ltd., India

18:30-20.00 Networking Cocktail Reception

Friday 23rd September 2016

09.00 Registration and welcome coffee
09.30 Opening announcements

SESSION 5 - SEEKING STABILITY – THE LATEST ADVANCES IN STABILIZATION

09.40 **Light stabilization of automotive compounds**
Mr. Gregor Huber, Global Competence Centers – Head Automotive,
BASF SWITZERLAND, Switzerland

10.10 **High performance stabilization systems for selected polyolefin applications**
Dr. Baburaj S. Iyer, Regional Technical Service – India & SEA,
SONGWON SPECIALTY CHEMICALS – INDIA Pvt. Ltd., India

SESSION 6 - SPECIFYING AND OPTIMIZING COMPOUNDING LINES

10.40 **More torque or more volume? Which is more important for compounding?**
Dr.-Ing. Thomas Winkelmann, Head of Department Plastics Technology,
KRAUSSMAFFEI BERSTORFF, Germany

11.10-11.40 Morning coffee

11.40 **Sustainable material handling solutions for a modern compounding process**
Mr. Michele Fona, Sales Area Manager,
PENTA S.r.l., Italy

12.10 **Specifying twin-screw compounding extruders – how to identify the right machine for the job**
Mr. Adam Dreiblatt, Director of Process Technology,
CPM CENTURY EXTRUSION, United States

12.40 **How to design highly flexible and efficient compounding lines for small lots and quick product changes**
Mr. Manfred Wiedmann, General Manager Business Unit Modular & Turnkey Systems,
COPERION GmbH, Germany

13.10-14.30 Lunch sponsored by: Penta A Piovan Company

14.30 **Comparing strand and underwater pelletizing technologies for optimized compounding lines**
Mr. Klaus G. Arlandt, Sales Manager Asia,
MAAG AUTOMATIK GmbH, Germany

SESSION 7- IMPROVING THE CONTROL AND MONITORING OF COMPOUNDING OPERATIONS

15.00 **Industry 4.0 for PP-large scale compounding - an example of an inline MFI closed-loop control measurement**
Mr. Sven Wolf, Managing Director,
LEISTRITZ EXTRUSIONSTECHNIK GmbH, Germany

15.30 **New ways to inspect and improve plastic pellet quality, both on-line and off-line**
Mr. Holger Lieder, Sales Director,
SIKORA AG, Germany

16.00 Afternoon tea and conference ends

Conference lanyard sponsored by: STEER

iPad prize draw sponsored by: Leistritz

AMI reserves the right to alter the programme without notice. See the latest programme and confirmed speakers at: ***www.amiconferences.com***

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If more than one delegate please photocopy form

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Surname: _____

Position: _____

Special dietary requirements: _____

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PAYMENT DETAILS

All payments to be made in USD

Please tick box and write amount:

❑ Early bird admission fee: *(Until 22nd July 2016)*	USD1320	_____
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COMPOUNDING WORLD ASIA 2016

CONFERENCE INFORMATION

Date and location

22-23 September 2016
Grand Copthorne Waterfront Hotel
392 Havelock Road
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Fax: +65 6737 8880

Registration fee

The registration fee includes attendance at all conference sessions, the Networking Cocktail Reception, lunch and refreshment breaks on all days and a set of conference proceedings.

- ***Early bird registration:*** Register before 22nd July 2016 for only USD1320. Thereafter the cost is USD450.
- ***Group rates:*** For companies wishing to register two or more delegates, group discounts are available. Please contact the Conference Organiser for more details. (Please note to qualify for the group discount delegates must be booked at the same time, otherwise additional delegates may be charged at full price.)

Compounding World Asia 2016 table top exhibition

A limited number of table top exhibition spaces are available in the registration area and coffee lounge directly outside the conference room. The table top exhibition fee is excellent value for money and **includes 1 delegate place**. Exhibitors may either use tables provided by the hotel or bring their own stand or display.

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- ***Networking Cocktail Reception:*** A cocktail reception will be held after a day of conference sessions on the first evening. All delegates are invited to attend and it will offer an excellent opportunity to meet speakers and other colleagues. The Networking Cocktail Reception will run approximately from 18:30 to 20:00 and is included in the delegate fee.

Hotel accommodation

Delegates are responsible for arranging their own hotel accommodation whilst attending the conference. However, AMI have reserved a limited number of rooms for delegates at the Grand Copthorne Waterfront Hotel, at the rate of S$250 (plus taxes) for a superior room and of S$280 (plus taxes) for a Deluxe room including breakfast and Wi-Fi.

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Please state that you will be attending "AMI's Compounding World Asia 2016", and note that after the 19th August 2016 the above rates and conditions might not be available, so please book early.

Alternatively, download a copy of the hotel booking form from the website www.amiconferences.com

Cancellations

Full refunds, less a cancellation charge of USD300 will only be made on cancellations received prior to 19th August 2016. Thereafter we regret that no refunds can be made. Delegates may be substituted at any time. Please note that refunds will not be given on table top bookings, sponsorship packages or Conference Dinner places.

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Plasticiser producers are developing new products that meet user demands for higher performance and lower migration while addressing regulator concerns over safety, writes **Peter Mapleston**

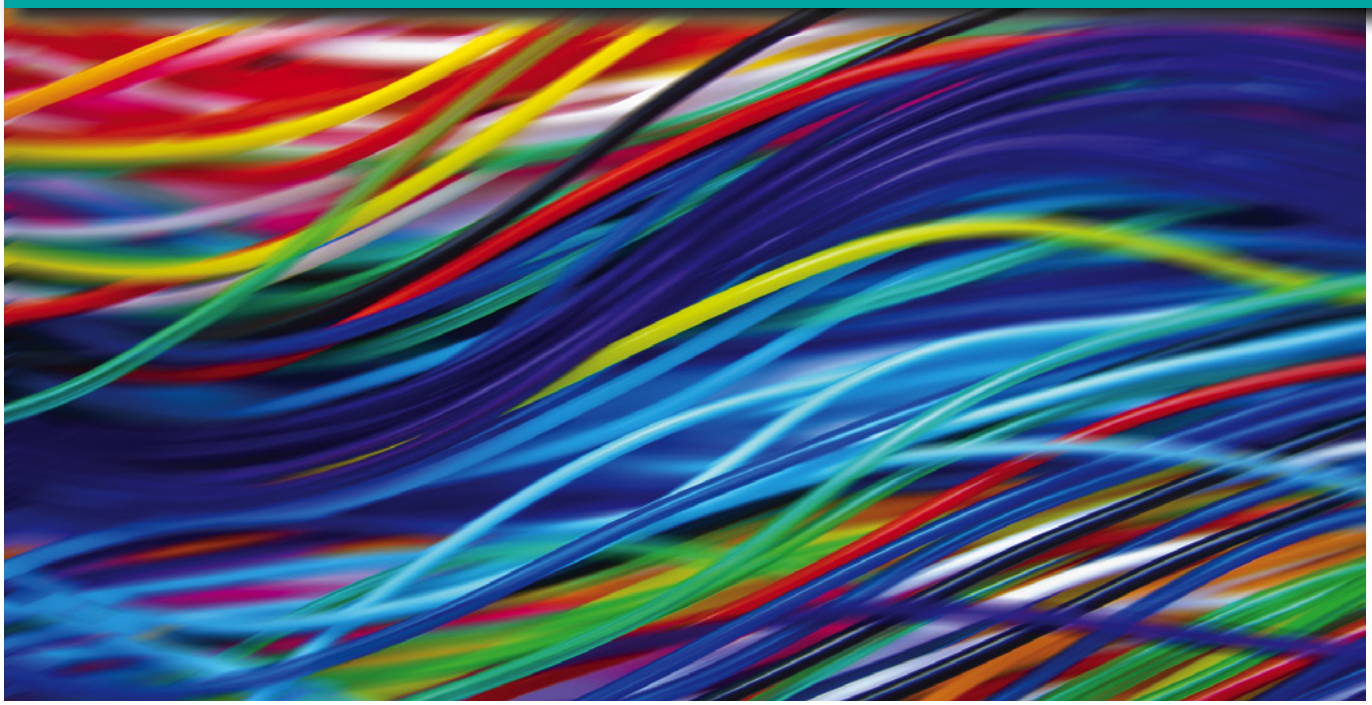


PHOTO: POLYONE

Plasticiser industry offers users many more options

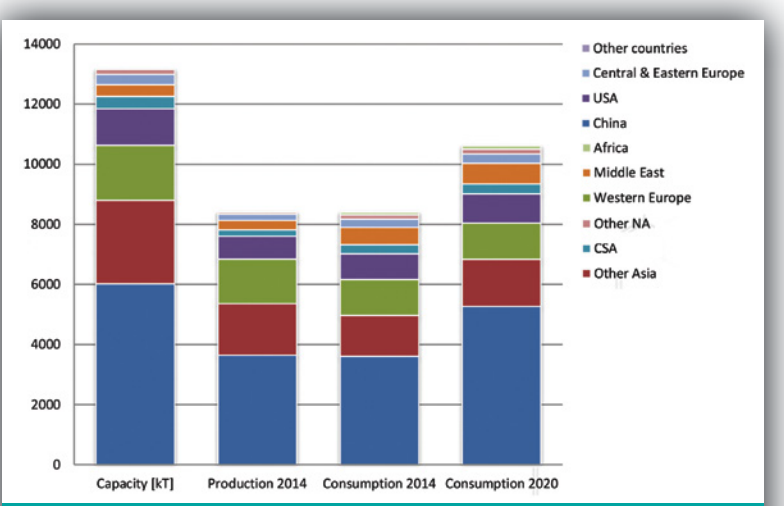
The global market for PVC plasticisers continues to grow and at a relatively healthy rate (around 4% a year, according to IHS). At the same time, the options available to formulators continue to extend. Bio-based types are available but appear to be taking a while to take off, largely because of their price premium, but to counter that there is plenty of activity in development of alternatives to lower molecular weight phthalates.

Emerald Kalama Chemical points out that just four phthalates - DEHP, DINP, DPHP, and DIDP - account for the bulk of PVC plasticiser consumption worldwide. But their market share is falling year-on-year. "Formulators may turn to terephthalates such as DEHTP or to [something like] di-isononyl cyclohexanoate," a spokesperson for the company says. "However, in many applications, formulators cannot achieve needed end use performance with these non-phthalate general-purpose plasticisers alone. Despite concerns with health, environment, and meeting regulations, it is still essential to optimise and tailor key properties and processing characteristics, such as long-term durability, viscosity, fusion time, and film strength."

Historically, orthophthalates such as BBP were favoured for their fast fusion and economy, but use of BBP has been phased out entirely in the EU, with other regions following close behind. "Today, many formulators will utilise blends of non-phthalate general purpose and other high solvator plasticisers—such as dibenzoates—to improve compatibility and optimise a balance of desired performance properties and economy," the company says.

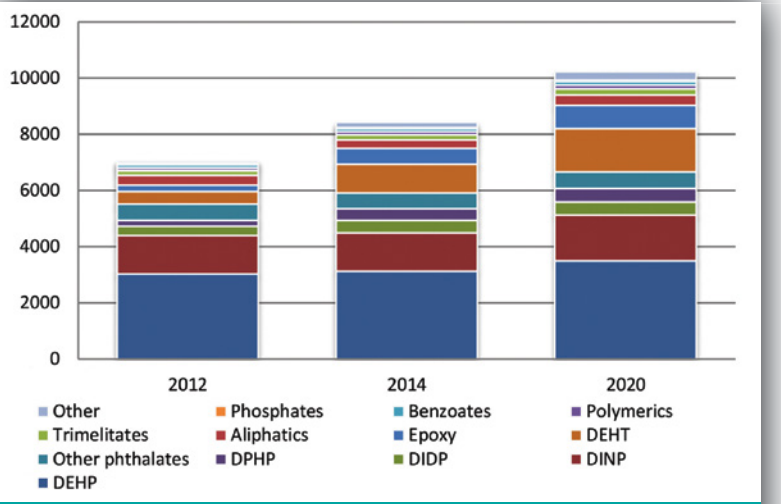
"Dibenzoates have excellent compatibility with a wide range of polar polymers. They outperform phthalates such as DINP for properties such as stain and extraction resistance, are more efficient (10 to 15%), and offer greater compatibility. As high solvators, dibenzoate plasticisers also contribute to lower gel fusion temperatures and increased line speeds. As a result, manufacturers of resilient flooring, spread coatings, and foam plastisols have increasingly utilised

Main image: Wire and cable is one of the largest and most technically demanding global markets for plasticisers



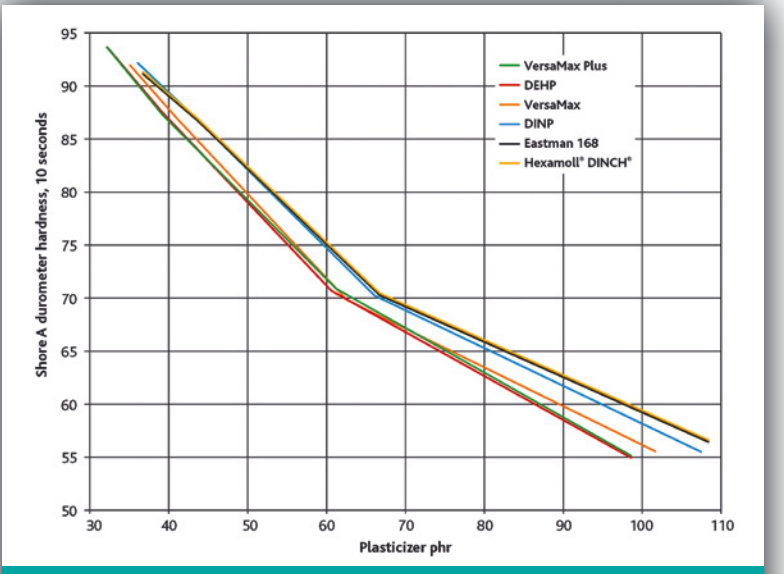
Global plasticiser balance (kT)

Source: GA ZAK estimates, IHS



Global plasticiser consumption by type (kT)

Source: GA ZAK estimates, IHS



Efficiency of various plasticisers, according to Eastman

dibenzoates in recent years," according to the company.

Emerald Kalama offers such products under the K-Flex banner and says it continues to focus R&D on optimising and enhancing end use performance. It notes that high solvators are not a drop-in replacement for other plasticisers; it is necessary to adjust the formulation in order to prevent unwanted viscosity increases. Use of dibenzoates in blends can resolve this problem.

Another recent priority for Emerald Kalama has been to increase the formulator's latitude to tailor performance characteristics for specific end use applications. It cites K-Flex 975P, which comprises a highly compatible, dibenzoate-based composition designed for improved processing and handling over other modern dibenzoate blends as well as providing enhanced properties such as stain resistance and durability.

Emerald Kalama completed REACH registration for the new composition last year and was granted patents and applications in use for K-Flex 975P covering a number of countries in June. The company also has several developmental dibenzoate plasticisers specifically designed to compatibilise less compatible GP non-ortho-phthalate plasticisers.

This March, **Eastman Chemical Company** unveiled the second member of its nonphthalate plasticiser portfolio, VersaMax Plus. The new grade complements the original VersaMax product and, like the original, is a terephthalate. Eastman describes VersaMax Plus as an enhanced, general-purpose, non-phthalate solution that provides better efficiency, improved dry time, lower and stable plastisol viscosity, and faster fusion when compared to traditional orthophthalate plasticisers and other non-phthalate options. It says it is suitable for use in plastisols and dryblends.

VersaMax Plus is said to demonstrate performance consistent to DEHP across a variety of Shore A hardness levels while outperforming DINP (diisononyl phthalate).

Overcoming difficulties

Mark Holt, director of market development and advocacy for Eastman's plasticiser business, says that development of the two VersaMax products came in response to difficulties that a number of customers had been experiencing in reformulating compounds with its well-established Eastman 168 grade as they moved away from more traditional plasticisers.

"With VersaMax, we have a product they can use like plasticisers they have been used to in terms of compatibility, dry time, efficiency and things like that," he says. "Now with VersaMax Plus we give formulators with even lower fusion temperatures, faster gelation...it really matches the performance of DEHP in many plastisol and dry blend formulations. You get a wider formulation

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Typical plasticiser performance data in dry blends

	VersaMax Plus	DEHP	VersaMax	DINP	Eastman 168	Hexamoll® DINCH®
Dry time, min	2.4	2.7	2.9	3.7	3.5	4.1
Shore A hardness	70	70	72	73	73	74
Tensile @ break (MPa)	15.5	14.1	15.2	14.4	14.7	14.0

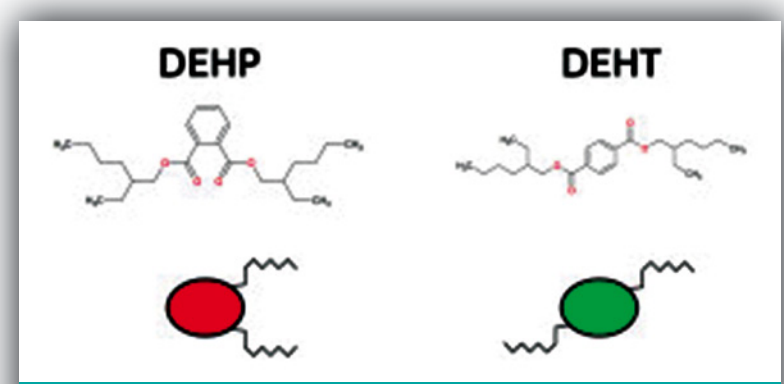
Component	PHR
K70 suspension resin	100
Plasticizer	70
Clay	18
ESO (epoxidized soybean oil)	5

window than you get with DEHT and most non-phthalate plasticisers. Everyone still uses DEHP as the standard, and VersaMax allows them to meet that standard."

Both Eastman 168 and VersaMax will continue to be available, however. "A lot of people have been able to formulate just fine with these products," says Holt. "For situations where you really need high compatibility and fast dry times, VersaMax Plus gives you that. There are so many ways you can formulate PVC, it depends a lot on what equipment the customer has and what they are trying to achieve. There are places for all three products in the market."

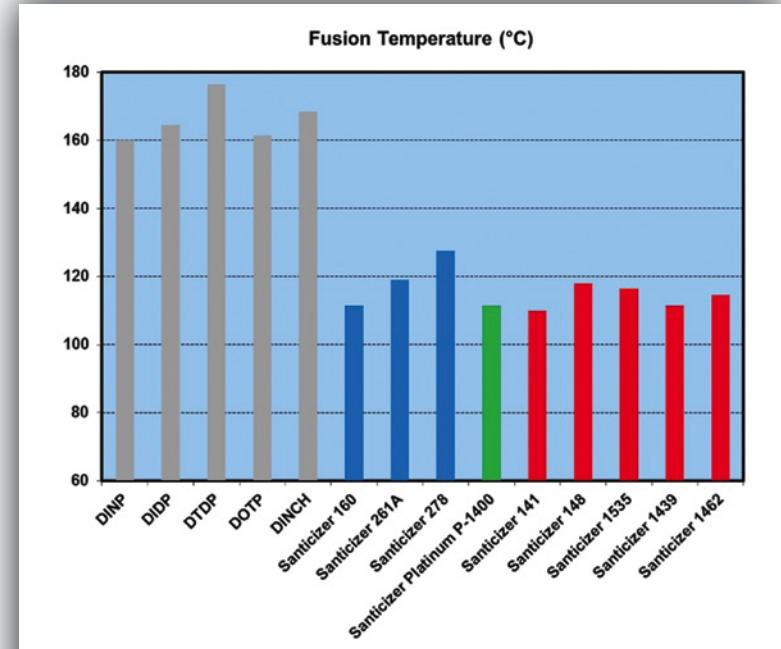
Terephthalate-based plasticisers are not recommended for applications requiring long-term weather resistance. For these, Eastman's extensive plasticiser portfolio includes Admex polymeric plasticisers. In addition, Holt says the company offers Benzoflex high solvating benzoate ester types, traditionally used in adhesives but increasingly used in PVC formulations.

At **Grupa Azoty**, Europe's fifth largest producer of oxo alcohols and plasticisers, company spokesman Grzegorz Kulik says the company will "in the near future" expand its plasticiser portfolio through the introduction of specialty esters, including bio-esters. For the moment, he says the company's existing Oxoviflex range is its response to the growing interest in



DEHT and DEHP are structural isomers: DEHP is a 1, 2-benzenedicarboxylic acid (ortho position = phthalic acid) esterified with 2-ethylhexanol while DEHT is a 1,4-benzenedicarboxylic isomer (para position=terephthalic acid)

Source: Grupa Azoty



Fast fusing Santicizer products versus general purpose plasticisers , Formulation (100phr PVC, 67phr plasticiser, 3phr stabilizer), Internal mixer (90 RPM, 3°C/min).

Source: Valtris Specialty Chemicals

non-phthalate plasticisers. Its formulation is based on Grupa Azoty's own 2-EH OXO alcohol and purified terephthalic acid (PTA). "It has been positively tested for usage in food packaging and child toys according to European regulations," Kulik points out.

Santicizer plasticisers from **Valtris Specialty Chemicals** encompass high solvating benzyl phthalates, flame retardant and smoke suppressing phosphate esters, and polymeric plasticisers. The family now also includes the non-phthalate Platinum range of cyclohexanoate products, which are high solvating and fast-fusing as well (the Santicizer name can be traced back to Monsanto, which put its polymer modifiers business into Solutia, from where it moved to Ferro in 2000 and then on to Valtris owner HIG Capital in 2014).

Karl Billast, EU/AP business manager for speciality plasticisers, says the Platinum products are similar in performance to benzyl phthalates, but without the regulatory concerns. Santicizer Platinum P-1400, a butyl benzyl cyclohexanoate, was commercialised in the US in 2014. In Europe, it has been PPORD (product and process orientated research and development) registered, which allows for sampling to enable product and process testing. Full REACH registration and subsequent commercialisation are expected to be finalised around the end of this year.

Valtris is already developing the next product in the Platinum family, Billast says. Santicizer Platinum P-1700, a long chain (C12) cyclohexanoate, is expected to be introduced in the US later this year. It offers superior VOC characteristics and will be targeted at specialty automotive and building applications.

"Santicizer specialty plasticisers differ from general purpose plasticisers because of their unique asymmetrical chemical structure of benzyl and alkyl functionality," Billast says. "Fast-fusing Santicizer products contribute to energy savings and faster processing thanks to lower fusion temperatures or times." The asymmetric structure also gives Santicizer products higher polarity and a solubility parameter closer to that of PVC, he says.

Proven advantages

Perstorp is talking up plasticisers based on C10 chemistry. "On all technical performance parameters, phthalate ester plasticisers based on isomeric C10 alcohols deliver a level of excellence that C8-9 plasticisers cannot achieve," claims Anders Magnusson, Technical Market Development Manager for Plasticisers at the company. He says such plasticisers offer proven advantages in weather resistance, flexibility and overall wear and tear. This provides sustainable and low maintenance solutions for tough outdoor applications.

There are two C10 general purpose plasticisers, dipropylheptyl phthalate (DPHP)—which Perstorp markets as Emoltene—and diisodecyl phthalate (DIDP). Both provide similar performance properties, with DPHP marginally better in some areas. Magnusson says there are seven key areas where C10 plasticisers can show a clear advantage over their C8-9 rivals: they have lower volatility; an exceptionally low level of water absorption; low fogging; high UV stability (especially DPHP) and ageing performance; very low migration; lower density; and they are non-classified under REACH.

Perstorp also offers a non-phthalate general

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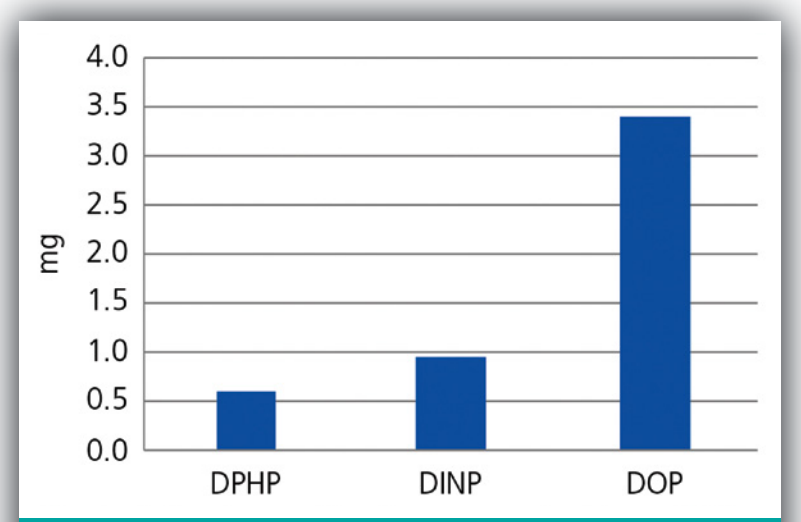
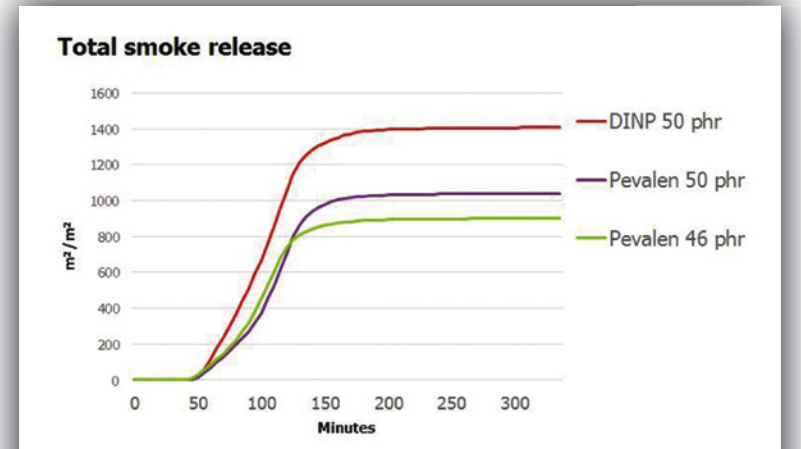


Fogging profile of common plasticisers. C10 (DPHP) has a significantly lower fogging profile



Graph showing the amount of smoke given off by different flexible PVC formulations in the Cone Calorimeter. Formulations containing 50phr of Pevalen give off much less smoke than formulations containing the same amount of DINP. The difference is even more significant when formulations of the same softness are compared (Pevalen 46phr).

Source: Perstorp

purpose polyol ester plasticiser, Pevalen, for close-to-consumer applications. The company says new advantages are now emerging for this product. Researchers recently studied various formulations using Pevalen and DINP and, when they compared formulations with the same hardness, they found that formulations based on Pevalen had superior performance in terms of smoke release.

They also found that the limiting oxygen index (LOI) of formulations containing Pevalen and a number of different types of flame retardant, most notably antimony oxide, were better than formulations containing DINP (which it speculates may be due to synergies between the plasticiser and the flame retardant). Pevalen does not appear to be inherently more flame retardant than DINP but, because formulations do not need as much of the Perstorp product, there is a marked difference in the fire properties of the PVC/plasticiser combination.

"Particularly impressive are the gelation characteristics," Perstorp claims. "Because it gels faster at any given temperature compared to other plasticisers, Pevalen enables production speeds to be increased and/or energy consumption to be reduced." Processors can also benefit from its low viscosity and low volatility, the company says.

"The results on fire properties are only preliminary, and we need to deepen our investigations before we make any categorical claims," says David Bray, Plasticisers Product Manager at Perstorp. "But we are optimistic that further research will confirm what we have already seen.

Fire performance

Grupa Azoty has also reported on positive effects on fire performance with its Oxoviflex DEHT plasticiser. Application Laboratory Manager Ryszard Grzybek and Strategic Marketing Manager Maciej Budner spoke about the potential for synergies between Oxoviflex and mineral additives in both rigid and flexible PVC at AMI's PVC Formulation 2016 conference in Cologne in April (where Perstorp's Magnusson also spoke). They said tests indicated improvements in flame resistance (both in terms of flame-out and total smoke release) and thermal properties.

Santicizer phosphate ester non-halogenated plasticisers from **Valtris** also bring good flame resistance combined with smoke suppression and high plasticiser efficiency. "They are of particular use in applications where the use of flame retarding fillers such as antimony oxide has to be reduced or avoided," Karl Billast notes.

Hallstar says it continues to expand its current product line of specialty esters. Dejan Andjelkovic, Technical Director of Polymer Additives, says there is an ongoing need for new product development. "Markets for these esters are mature but our customers are pushing to maximise performance to meet the ever-increasing demands," he says, highlighting increasingly stringent performance requirements for low -fogging esters for auto interiors. "The Fog Value from years ago was 75-85 and now 95 has become the new minimum," he notes. "Non-migration to polyurethane foam is an absolute need. Also low-temperature properties continue to need improvement with -30°C or better required by most of the automotive companies."

To address these higher performance requirements, Hallstar has developed Paraplex A-8862, a polymeric

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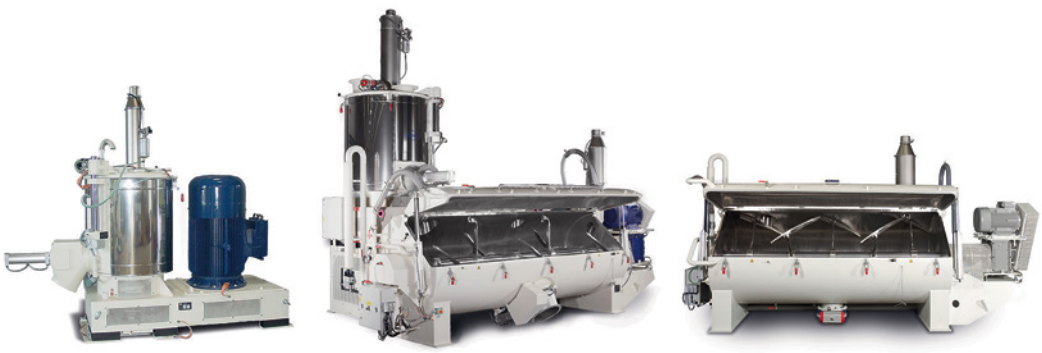

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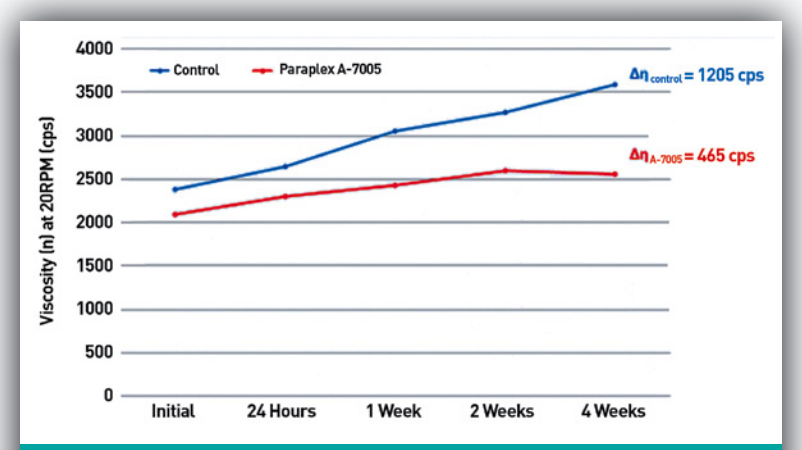
ester. It has a Fog Value in PVC compound of 98. Another new polymeric ester is Paraplex A-7020, developed for improved compatibility and lower PVC fusion temperature (102°C).

Hallstar is also addressing issues relating to viscosity. "Viscosity reducers/stabilisers have been around for many years and are typically based on various chemistries that do not contribute to any other physical properties of the PVC," it says. A new low viscosity polymeric ester, Paraplex A-7005, can reduce viscosity and control plastisol viscosity over time.



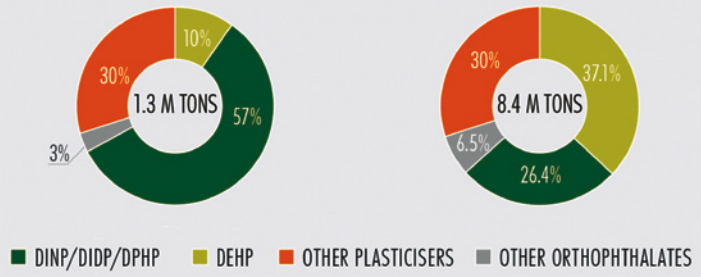
Hallstar's Paraplex A-7005 acts as a standard ester plasticiser and provides viscosity reduction and stabilisation for PVC plastisols. The company says it allows PVC plastisol compounders to remove viscosity depressants/ stabilizers without sacrificing performance

Fast response

PolyOne highlights its ability to quickly develop new formulations for particular customer needs. It cites SynPlast L9TM, which it developed last year as an alternative to 810TM, a specialty trimellitate plasticiser offered by numerous plasticiser manufacturers (including PolyOne) that was for a period in short supply.

The company says a leading wire and cable formulator was facing significant business risk due to a global supply disruption of the linear 810 alcohol used to produce 810TM - the formulator was struggling to achieve the necessary flexibility at both elevated and low temperatures. PolyOne worked with the customer to identify the in-depth requirements of the application and quickly delivered evaluation samples and preliminary performance data for a new L9TM (trinonyltrimellitate) plasticiser, made with linear 9 alcohol. This proved

European and global plasticiser usage by type



Source: ECPI/IHS

Plasticisers: A European regulatory update

Few chemicals have found themselves more central in the regulatory spotlight than phthalate plasticisers. For those that may not have kept pace with developments in this area in Europe, Cefic sector group ECPI (European Council for Plasticisers and Intemediates) has provided this update.

Over the last two decades, DINP has become the major plasticiser in the EU and one of the main alternatives to classified phthalates such as DEHP. More than one and a half years ago, the Danish EPA said it would submit a dossier to ECHA (European Chemicals Agency) requiring the harmonised classification and labelling (CLH) of DINP. This has still not been submitted and DINP can continue to be used in all current applications.

In December 2012, the ECHA RAC (Committee for Risk Assessment) rejected a proposal from the Danish EPA for the broad restriction of four phthalates in articles (DEHP, DBP, DIBP and BBP). Since then, the use of DBP, DIBP, and BBP in flexible PVC applications within the EU has been completely phased out. The use of DEHP has been further reduced due to replacement with alternative plasticisers.

In September 2014, the ECHA RAC and SEAC (Committee for Socio-Economic Analysis) recommended the authorisation of DEHP for a number of specific PVC compounding applications and in recycling of flexible PVC made with DEHP. In April 2016, the European Commission granted a four year authorisation for the formulation and use of recycled soft PVC containing DEHP to VinyLoop Ferrara, Stena Recycling and Plastic Planet.

ECHA and the Danish EPA are now proposing restrictions in articles of the same four phthalates for which RAC has already concluded that there is no risk. It is now appropriate for the REACH Committee to confirm authorisation of the use of DEHP in PVC compounding and the manufacture of original PVC articles, with restrictions only for non-authorised uses. Nevertheless, a decision on authorisation of DEHP for manufacturers (currently only the Czech company DEZA) has not been taken yet. Companies that have applied for authorisation are eligible to continue to produce DEHP and their customers in their downstream supply chain may continue use as specified in the applications (Regulation EC No 1907/2006, article 56, 1d).

www.ecpi.org

suitable for the application and the company says it was able to scale-up, produce and deliver the L9TM product within a week of receiving the purchase order.

At **Oxea**, Commercial Business Director for Specialty Esters and Amines Jacco de Haas highlights the company's Oxsoft and Oxblue ranges. Oxsoft is primarily focused on the continuing trend to move away from phthalate products. "Another trend is the concern about migration in general. Simply said, if a plasticiser is not migrating at all nobody would be concerned if the product is a phthalate or not. So next to moving away from phthalates, we clearly see a trend to move to products with a better migration profile," he says.

"Certainly in automotive applications migration is a concern. The 'new car' smell is actually nothing more than the smell of plasticisers migrating out. There is a global trend that in automotive this migration should be reduced and trimellitates are benefiting from this," according to de Haas. Oxea offer two kinds of trimellitates, Oxsoft TOTM (trioctyl trimellitate) and Oxsoft L9TM. He says the latter in particular is growing in automotive applications.

Outside automotive, de Haas says his company sees clear concerns concerning VOCs and migration in areas such as paints, artificial leather and wallcoverings. Larger molecules show better performance and are growing in importance, he notes. In addition to OTM and L9TM, Oxea also sells special products such as Oxsoft Duo 1 and 2. "Normally bigger molecules how lower migration but they are also harder to handle, basically due to their high viscosity," de Haas says. "The Duo products are developed to combine low migration with good handling properties."

Oxblue, meanwhile, is a partly bio-based plasticiser based on succinic acid. "The Oxblue product range was developed to try to combine the best of petrochemistry and best of biochemistry," de Haas says. "We saw with 100% bio-products that performance is not always good enough. This makes sense as they will biodegrade much easier. However, in PVC applications that is exactly what you want to prevent. The goal is to have products with a long life time."

Affordability focus

De Haas says the company also determined it could make the products much more affordable through the combination of petro and bio-based chemistries. "This indeed is and was a reason for success. At the moment, bio is still interesting for our customers but really more for marketing reasons - everybody just wants to have a bio product on the portfolio. And also, very clearly, no customer is prepared to pay a premium. Still Oxea is committed to promote Oxblue products, but we believe

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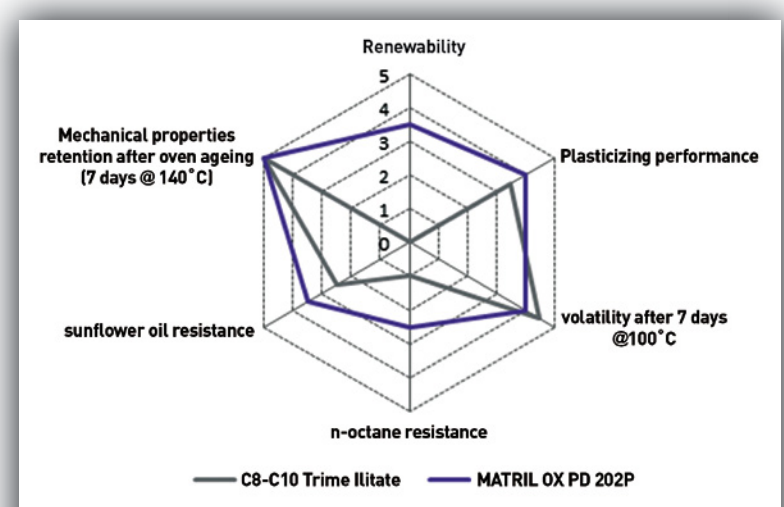

Comparison of key performance characteristics of Matrìca Matrilox bio-plasticiser against C8-C10 trimellitate *Source: Matrica*

that only being bio is not enough. Pricing and certainly performance should be the success factors."

Other players in the bio-field appear to be holding back too, at least for now. **Bio-Amber**, a major bio-succinic acid producer, declined to provide information for this article. At another succinic acid supplier, **Myriant**, Sales, Marketing and Business Development VP David LeBlanc confirmed that most activity among possible bio-plasticiser suppliers is still developmental. **GFBiochemicals**, which produces another potential bio-plasticiser feedstock (levulinic acid) directly from biomass and acquired Segetis earlier this year, also said it was too early to talk about commercial developments.

Meanwhile, Antonio Greco at the **University of Salento**, who is involved in the EU-sponsored Placard project aimed at developing technology for production of plasticisers from cashew nut shells says more information will be available after the project concludes at the end of this year.

The Matrilox range of bio-based plasticisers from **Matrìca** are claimed to offer high performance and are optimised for compatibility with polymers such as PVC and NBR. Developed and manufactured using technology from Novamont (a partner in the joint venture Matrìca operation with Versalis) at the company's bio-refinery at Porto Torres in Italy, the plasticisers are claimed to offer a favourable performance/cost ratio, high thermal stability, low volatility, and high extraction resistance (in particular in non-polar liquids).

According to Matrìca, Matrilox plasticisers are well suited for use as an alternative to linear trimellitates. The company cites potential application areas including flooring and cables.

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further information

Screw and barrel wear is a major contributor to reduced compounding efficiency and, ultimately, to compromised product quality. **Peter Mapleston** looks at the latest metallurgical developments

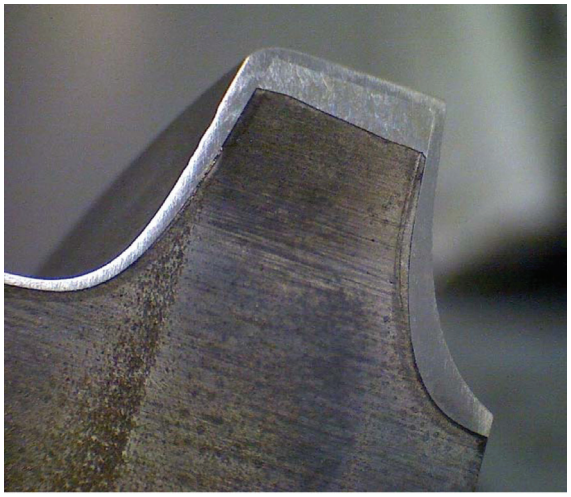
Screws and barrels can wear it well

Above: Matching metallurgy to the specific processing task is critical in managing wear and corrosion, according to Leistritz

Compounding extruder screws and barrels provide their optimum efficiency when they are new and in their "as designed" state. Over time these components will wear, especially when in contact with abrasive or corrosive materials, and efficiency can decrease notably. Machine adjustments can be used to compensate for this loss of efficiency but may introduce new problems including high shear rates, thermal degradation of polymers, greater cooling demand, and ultimately product inconsistency. Adjustments can, in some cases, actually accelerate the wear condition.

"Many factors determine the best time to repair or replace a feed screw/barrel but many processors continue operating well past this point," says one provider of wear resistant solutions. This article takes a look at what some key technology suppliers are doing in terms of developing special materials and surface treatments that can increase the performance and lifetime of screws, barrels and dies in thermoplastics compounding extrusion equipment.

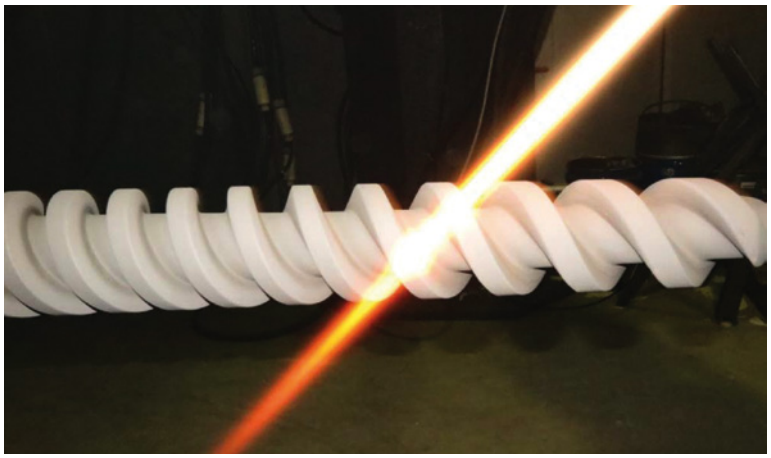
In the area of screw segments, the focus in on improving ductility for the screw segments while maintaining at least the same levels of wear resistance, says Dirk Zimmermann, General Manager at **Extruder Experts**, which specialises in highly wear-resistant special materials for all wearing parts in extruders. With extruders becoming more and more powerful in terms of throughput and torque rating, he says the area between the splined bore and the ground diameter of the screw segments becomes more and more loaded with forces that need to be transmitted into the processed materials.



Left: Cross section showing an Xaloy coated screw flight by Nordson

Zimmermann says his company is researching new materials that offer good ductility at the same level of wear resistance as the classical PM-HIP (powder metallurgy hot isostatic pressing) steels. Several materials are currently under test, "but only one new steel type showed really good results," he says. "Extruder Experts will do some more testing on these solid (non-bimetal) screw steels [before market introduction]" he says. For highly corrosive processes, the "old-style" tip-welded bimetal solutions are still judged to be the best for twin screw extruders, he says though.

Discussing barrels, Zimmermann says that, as the most expensive wear parts (aside from the screw shaft), these should last at least two to three times as long as the screw segments in the melting zone. "So the search is still on to find very high wear resistant liners or cladding on the surface of the barrels. We at Extruder



Above: Application of thermal spray powder coating to a screw at Nordson

Experts developed a method to weld a powder mix of very small, round tungsten carbides in a nickel-layer to the surface of the screw bore. With 60-70% of tungsten carbides, we reach a very high level of wear resistance," he says. The company claims that, using the round carbides, the adhesive wear partnership with the screw segments becomes very favorable compared to well-known brazing systems.

On a general level, Zimmermann says today's higher torque ratings and longer processing sections are making adhesive wear more important than in the past. "It is a fact that smaller shafts at higher speeds get more torque bending and tend to [require] support towards the barrel wall, especially in the kneading sections and also at the die end. Screw segments are pushed towards the barrel wall with great forces, which creates a huge adhesive wear component. A very well prepared combination of screw material and barrel material needs to be found to get this wear component under control."

Tungsten carbides also feature in what sounds like a major new development from **Nordson Corp**, which the company is set to introduce at K 2016. "A technology that uses exceedingly tiny tungsten carbide spheres barely larger than the particles in cigarette smoke has yielded a coating for single and twin plasticating screws that resists abrasive and corrosive wear better than standard coatings applied by high-velocity oxygen fuel (HVOF) thermal spray," the company claims in a pre-show information release.

The new Xaloy MPX thermal spray coating is made up of particles only 0.005 mm in diameter. Consisting primarily of tungsten carbide, the particles are said to be six to seven times smaller than those in standard HVOF coatings and more densely packed owing to a uniform spherical shape produced in a controlled plasma process. "The combination of ultra-fine particle size, higher coating density, and a 2.5 times greater application velocity results in a stronger bond with the parent metal of the screw and improved resistance to wear," says Nordson.

"Compared with standard HVOF tungsten carbide coatings, the Xaloy MPX technology exhibits 61% less mass loss in ASTM G65 abrasion testing, 18% less mass loss in ASTM G77 sliding wear testing, and 8.5% greater bond strength in ASTM C633 bond testing," the company says. As an example of corrosion resistance, it says the Xaloy MPX coating survived more than 1,000 hours of salt fog testing, in part attributed to its near-zero porosity.

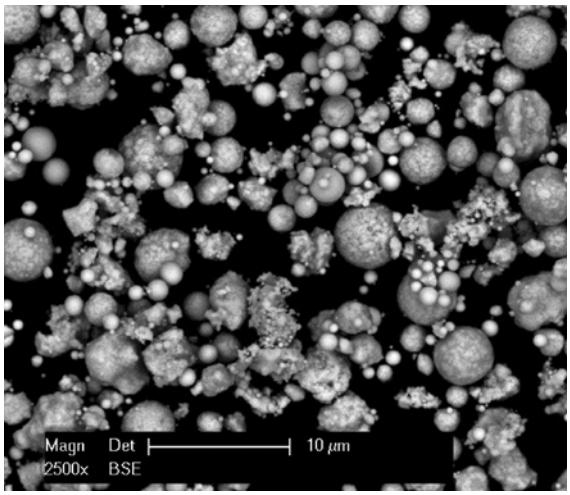
"Nordson's Xaloy MPX screw coating provides best-in-class wear protection compared with standard HVOF coatings, and its higher bond strength eliminates potential for chipping," says Mark Colella, Global Product Manager for the Xaloy brand.

Nordson recommends the Xaloy MPX technology for resistance to abrasion from compounds with medium (15 to 35%) filler loadings and for resistance to corrosion from halogenated materials, including flame retardants and PVC. For filler contents above 35%, Nordson supplies the high-hardness coating Xaloy X-8000.

The Xaloy MPX technology can be employed across the full range of screw diameters and may be applied to the entire screw or to specific areas. The standard layer thickness is 300 microns, with variations utilised depending on the area of the screw. Nordson says the new screw coating should be used with a barrel lined with its Xaloy X-800 nickel/tungsten carbide alloy or a comparable inlay.

Treatment specialist **Extreme Coatings** offers CarbideX, a blend of tungsten carbide in a nickel or cobalt matrix engineered to resist wear on screws in equipment producing abrasive compounds such as glass-reinforced polyamides or calcium carbonate-filled PVC. According to the company, feed screws coated with CarbideX are two to three times more wear resistant than standard bimetallic screws.

CarbideX is also very useful where corrosion is the



Right: Nordson claims the fine particles in its new Xaloy MPX allow it to outperform current HVOF alternatives

“ ENTEK Extruders and Wear Parts Help Fiberon Produce the Highest Quality Wood-Plastic Composite Decking ”

Mike Huskey,
Vice President of Manufacturing, Fiberon

ENTEK’s Dr. Kirk Hanawalt (left) with Fiberon’s Plant Manager, Ken Ropski (center) and Mike Huskey at Fiberon’s plant in Meridian, Idaho

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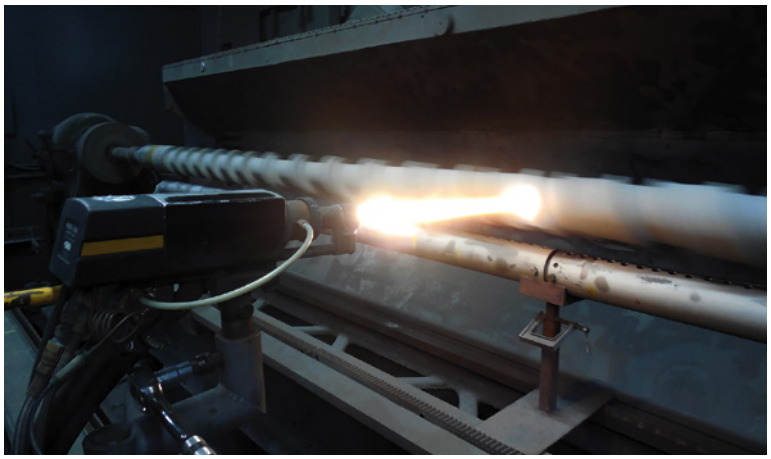

Above: Application of a wear resistant coating at Extreme Coatings

main wear mode, according to Tom Kvinge, Marketing Manager at Extreme Coatings. "Our thermal spray coatings have almost no porosity so they protect from highly corrosive materials like CPVC, fluoropolymers, and halogen-free flame retardants," he says.

The company initially offered only complete encapsulation of a feed screw surface, but says that not all processors require this level of protection. Its FliteGuard system for extrusion screws provides a coating on just the flight tops.

"FliteGuard is a great option where adhesive wear is the main mode of wear," says Kvinge. "FliteGuard can also be used to bring a worn tool steel screw back to dimension. Usually tool steel (particle metallurgy or highly alloyed D2 steels) cannot be weld repaired. FliteGuard is a great option to put these expensive screws back into service."

The company also offers CarbideX CPR (Chrome Plating Replacement) thermal spray coating, which it says is considerably better than hard chrome plating (HCP) for screws and rotors in equipment processing PVC. The company says corrosive fumes created in PVC processing permeate the micro-cracks and pores in HCP. "In the past, HCP was the primary option for PVC and CPVC [but] HCP does not provide adequate protection of the base material, ultimately leading to premature wear, excessive scrap and downtime."

CarbideX CPR is a blend of carbon and chromium in a nickel matrix. According to the supplier, it is applied two to three times thicker (0.8 – 0.1 mm) and more uniformly than standard HCP and fully encapsulates the entire working surface of the screw. "It is difficult to deposit a

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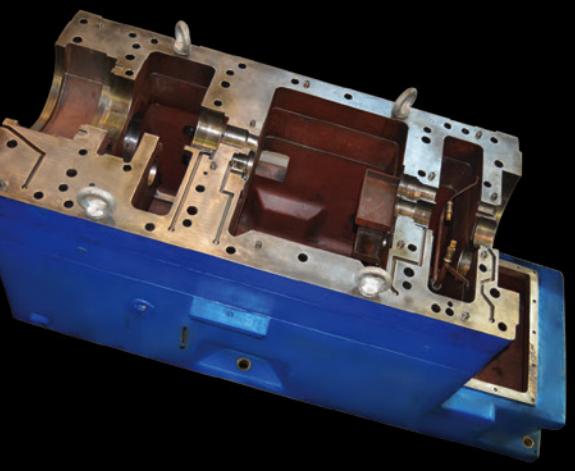

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Above: A hard coated feed screw with mirror finish by Extreme Coatings

uniform layer of chrome on complex geometries," claims Kvinge. "This makes chrome susceptible to premature wear as the thickness and inherent porosity cannot handle an aggressive process." Service life with CarbideX CPR is claimed to be up to five times longer than with HCP, and screws can be recoated many times.

At K 2016, Extreme Coatings may be ready to showcase some new formulations, Kvinge says. These involve variations on size and composition of the constituent carbides to tailor a coating to a specific wear mode. "This can be towards the high end of the market but also our CPR is truly a product to replace highly toxic chrome plating," he says.

Kvinge adds that the company has been very successful with using its CPR for treating twin co–rotating compound mixing rotors, but less so with twin screw elements. "Our standard thickness of 0.75 mm per side is not sufficient to extend element life significantly," he admits. "Most processors will allow screw elements to wear up to 3-4 mm. If corrosion is present then we can add triple or more life to screw elements."

For now, the company does not coat barrels. "We provide consumable alloys to the manufacturers of barrels," Kvinge says. "We focus on line-of-sight outside diameter (OD) surfaces for our thermal spray process; however, we do have an experimental inside diameter (ID) thermal spray gun that we are evaluating."

Bill Novak, Product Manager at extruder producer **Leistritz**, says there have been significant advances in just about all types of materials for improving wear resistance in compounding equipment. "The most prevalent use is PM steels, which offer the most cost effective alternative. All extruder suppliers have access to the same metallurgies. Where Leistritz excels is in choosing the best suited metallurgy to protect against the wear type, or combination of wear types," he says. "While the mechanisms of abrasive, adhesive, and corrosive wear may be known by manufacturers, there are only a few who harden/heat treat the PM steel consistently enough and provide guidance on matching barrel and screw element materials," Novak claims.

A recent advance in PM steels at Leistritz yielded VSA4 materials with excellent wear resistant as well as corrosive resistant properties, "but it is in the heat treatment and finishing that allows the parts to be crafted to such tight tolerances and long-lasting effect," according to Novak. This is accomplished with an outer shell of VSA4 material surrounding an inner core of more resilient yet tough steel. This screw element metallurgy, in conjunction with the VSA4 barrel metallurgy, is claimed to provide an excellent combination to protect in most processing tasks.

Century Extrusion has also developed a number of material options designed to maximise part life in both abrasive and corrosive wear applications, according to Twin Screw Systems Engineering Manager Janik Bessinger. "As engineered plastics evolved, compounding applications that generated both high abrasive and corrosive wear became common. Century Extrusion recognised this trend 20 years ago and began to develop wear materials to improve part life in these applications," he says. "It is important to note that part life is affected by the material of construction and the geometry or mechanical design of the part – which differs significantly among twin screw extruder OEMs," Bessinger adds. Century's proprietary wear material 10V-12, used to manufacture bi-metallic metal screw segments, was developed for high wear applications with moderate corrosion. The material is produced from powdered steel and uses the HIP process. It also features a soft core (made from carbon steel) to eliminate localised spline deformation at screw interfaces and crack propagation in the root of the screw spline resulting from unexpected torque spikes.

"As the requirement for higher corrosion resistance has increased, we have developed a number of other PM steels loaded with vanadium carbide for wear resistance and higher levels of chromium or nickel for corrosion resistance," says Century's Components Engineering Manager Bob Stratz. "In addition, we now offer PM bi-metal screw elements with cores made from stainless steel to protect the inner part of the element from corrosion."

Right: Krauss-Maffei Berstorff says its oval liners are a cost-effective solution for wear-intensive compounding processes

Barrel wear solutions create a greater engineering challenge, according to Stratz. Wear

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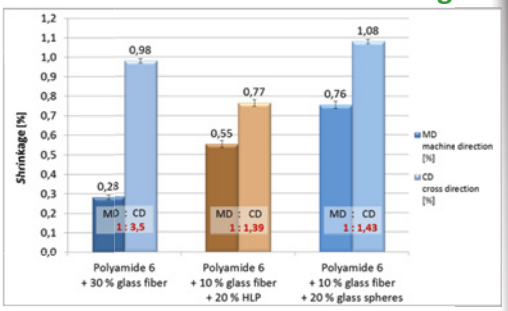
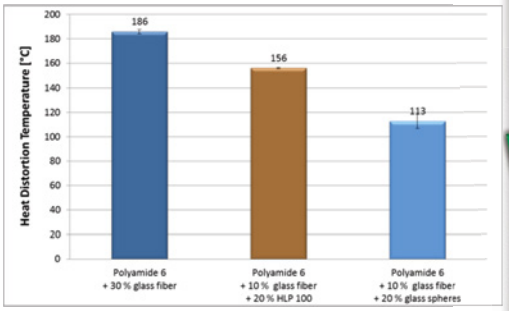
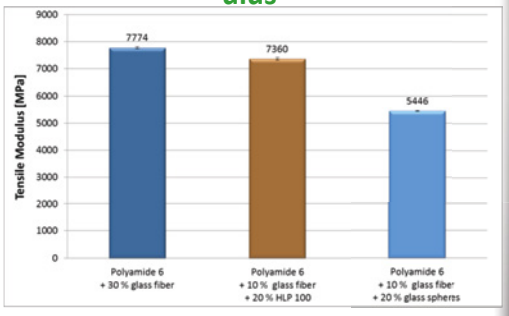
PA 6 filled with glass fiber and Mica HLP 100—Test Results Shrinkage



PA 6 filled with glass fiber and Mica HLP 100—Test Results HDT



PA 6 filled with glass fiber and Mica HLP 100—Test Results Tensile Modulus



Mica has a significant influence on the shrinkage; it reduces the overall shrinkage and balances the anisotropism compared to the pure glass fiber compound and compared to the addition of glass spheres as well; also HDT is higher and mechanical properties are ideal.

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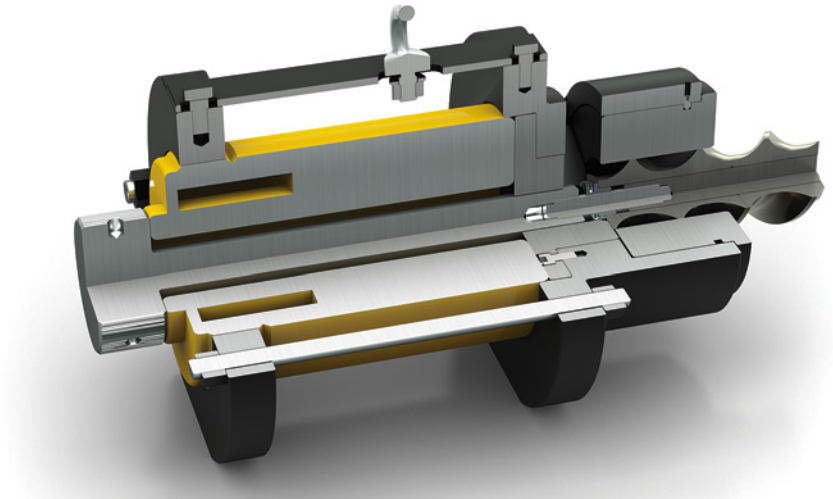

Above: This hydraulic pre-tensioning unit from KraussMaffei Berstorff is said to reduce frequency of cleaning

surfaces can be applied via surface hardening, through-hardening, cladding and also the application of materials via welding and numerous other processes. "Through hardening and surface hardening have limited wear resistance because of hardness limitations and wear surface thickness limitations. Cladding processes are inherently plagued by hair line cracks. These cracks typically do not hurt abrasive wear performance, but when corrosive attack is present, compounds will penetrate the cracks and attack less corrosive base materials causing failures," he explains.Century says it has approached thes problems from two directions. First, it has developed CX 77 with high levels of tungsten carbide for abrasive wear resistance and nickel for corrosion resistance. "For highly corrosive applications, we have introduced CX 77 with stainless steel backing," Bessinger says. "We have also developed numerous hipped barrel wear solutions and continue to expand into new materials. The hipping process allows for highly tailored metallurgy and does not produce surface cracks. We offer hipped materials containing up to 65% tungsten carbide and high levels of chromium or nickel."

KraussMaffei Berstorff tries to counteract against increased wear with two measures: elliptical liners on its ZE Blue Power models and use of a hydraulic screw pretensioning system. The optional liners are described as a cost-effective solution for wear-intensive compounding processes, since, if required, only the liner rather than the entire barrel needs to be replaced. A contact collar avoids material leakage in the sealing face area due to different thermal expansion of liner and outer body.

The hydraulic screw preloading system overcomes

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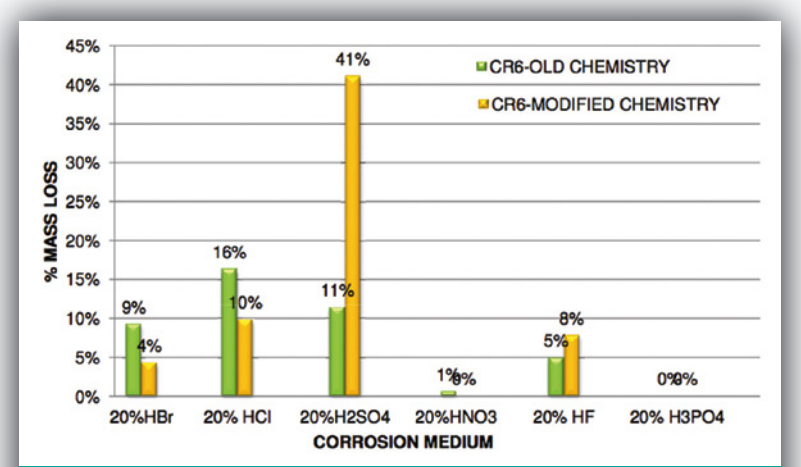
the disadvantages of manual preloading methods. It subjects the screw shafts to a defined tensile stress without exerting any torsion load. The machine operator selects the appropriate pressure specified in the machine documentation and clamps the extracted screw in the preloading system. The defined preloading forces are said to prevent the melt from penetrating between the screw element and the shaft and thus help to avoid time and cost consuming dismantling and cleaning operations.

All extruder sizes in the ZE BluePower and the ZE-UTX series can be preloaded with only three preloading systems. A processing company generally needs only one preloading system for all of its extruders, claims the company.

Feddem offers process barrels that are provided with highly wear-resistant coatings when customer or process requirements call for them. The special alloy is manufactured in the HIP-process (hot isostatic pressing). This coating can be applied over the entire process area.

Advanced tool steel and surface treatment R&D is a major area of focus at **Steer** and one that the company claims can significantly improve process efficiency, durability and life of its compounding platforms, elements and components. Thiru Arumugam, head of the company's tool steel operations, says its tool steel plant "was setup to drive innovation and create and develop tool steel that not only sets new benchmarks in performance, but allows our customers to work with new materials hitherto not possible, or realise significant efficiencies within existing processes."

He cites Acrolloy55, the latest grade in Steer's Acrolloy class of steel and a product of what the company refers to as Microgenic Technology. This is a vanadium-rich tool steel with other alloying and micro-alloying elements that together have very strong



Graph comparing cresistance of Steer's standard CR6 and new CR6-MOD corrosion protection coatings *Source: Steer*

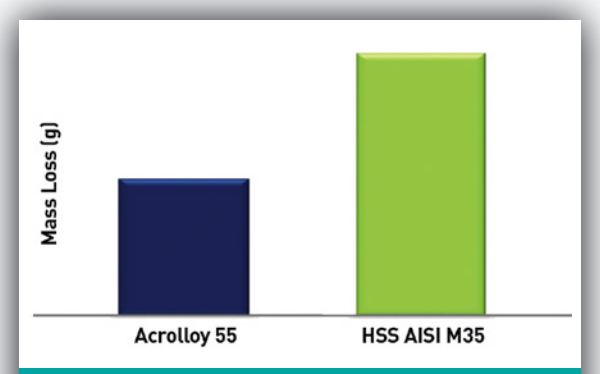


Chart showing abrasion resistance of Steer Acrolloy 55 against a current high speed steel grade *Source: Steer*

abrasion resistance. The uniformly distributed carbides, metallically bonded to the matrix, are claimed to exceed the wear properties of traditional HIP powder metallurgy steels "by a large margin."

Acrolloy 55 is a molybdenum high speed steel that has a wider heat treating range along with far greater resistance to decarburisation when compared to alternative high speed steels available today (HSS AISI M35 grade), a Steer spokesman claims. Acrolloy 55 also offers an excellent combination of red (or hot) hardness, toughness, wear resistance and cutting ability, along with fine grain and carbide particle size.

According to Steer's laboratory analysis, when compared to AISI M2 (the current top choice for flame retardant applications) Acrolloy 55 delivers far better properties both in a bromine and abrasion environment.

Steer CR6-MOD was developed to eliminate high corrosion of elements in equipment processing flame retardant polyamide compounds containing bromine and glass fibres. "Moreover, the presence of moisture in polyamides poses further complications while using Powder Metallurgy (PM) based steels," Arumugam notes. By modifying the chemistry, the company says it is able to achieve far greater corrosion resistance. "Besides being extremely cost effective when compared to PM steels, CR6-MOD also demonstrated increased erosion resistance, high compressive strength, excellent through-hardening properties and good dimensional stability during hardening," he says.

Click on the links for more information:

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Tuesday, September 27, 2016

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

9:10 **Market overview**
Mr. Chris Smith, Editor, AMI Magazines,
APPLIED MARKET INFORMATION Ltd., United Kingdom

SESSION 1 - PROCESSING AND COMPOUNDING

9:30 **Effective techniques for successful processing of electrically conductive plastic compounds**
Mr. Kari Alha, R&D Director,
PREMIX OY, Finland

10:00 **Challenges to produce electrically conductive plastics: The perspective of a conductive carbon black supplier**
Ing. Christine Van Bellingen, Global Polymer Technical Leader,
IMERYS GRAPHITE & CARBON, Belgium

10:30-11:00 Coffee break

11:00 **Continuous processing techniques for highly filled conductive plastic compounds**
Mr. Mario Gillmann, Research Associate,
ZENTRUM FÜR BRENNSTOFFZELLENTECHNIK ZBT GmbH, Germany

SESSION 2 - ENHANCING ELECTRICAL/THERMAL CONDUCTIVITY

11:30 **High performance boron nitride fillers for thermal management in polymers for E&E: Key properties, application examples and design considerations**
Ms. Kristi Gangelhoff, Advanced Application Development Engineer,
3M COMPANY, United States

12:00 **Advanced thermo management with mineral fillers in plastic materials**
Mr. Péter Sebö, Market Development Manager,
HPF THE MINERAL ENGINEERS, A DIVISION OF QUARZWERKE GROUP, Germany

12:30-2:00 Lunch

2:00 **Modifying thermal and electrical conductivity using novel infused hybrid nanostructures**
Dr. Tushar Shah, Chief Technology Officer,
APPLIED NANOSTRUCTURED SOLUTIONS, United States

2:30 **Highly electro-conductive carbon black in polyolefins, engineering plastics and polymer blends**
Dr. Josef Křivánek, Senior Researcher,
UNIPETROL RPA s.r.o. - POLYMER INSTITUTE BRNO, Czech Republic

3:00 **Electrically and/or thermally conductive polymers incorporating transitional metal nanoparticles**
Mr. Nate Slating, Director of Business Development,
THE MACKINAC GROUP, INC., United States

3:30-4:00 Coffee break sponsored by: Unipetrol ORLEN GROUP

SESSION 3 - THERMALLY CONDUCTIVE APPLICATIONS

4:00 **Simplified manufacturing of 3D-mids with thermally conductive polymers**
Mr. Jason Eckel, Global Marketing Director,
Specialty Engineered Materials,
POLYONE CORP., United States

4:30 **Thermal management of Li-ion systems & mobile devices with latent heat sink (LHS) plastics**
Mr. Mark Hartmann, CTO,
OUTLAST TECHNOLOGIES LLC, United States

5:00 **Thermal management solution for LED application with customized polymers**
Mr. Ted Sidoriak, Product Manager - North America,
LEHVOSS NORTH AMERICA, United States

5:30 Afternoon wrap-up and questions

5:40 - 7:10 Cocktail reception

Wednesday, September 28, 2016

8:30 Welcome coffee
9:00 Opening announcements

SESSION 4 - NOVEL CONDUCTIVE ADDITIVES

9:10 **Developing and enhancing conductive properties using novel porous isotropic 3D carbon structures**
Dr. Daniela Sordi, Chief Technology Officer,
CARBONX BV, The Netherlands

9:40 **Single-walled carbon nanotubes as a novel conductive filler for thermoplastic materials**
Dr. Evgeniy Ilin, Senior Researcher,
OCSIAL GROUP, United States

SESSION 5 - ELECTRICAL CONDUCTIVE APPLICATIONS

10:10 **Application of highly conductive aliphatic polyketone to reduce weight and cost in LEV III compliant auto fuel systems**
Mr. James Arbuckle, Managing Partner,
MEGA POLYMERS, United States

10:40-11:10 Coffee break

11:10 **Development of a highly conductive polymer bipolar plate for high performance lead-acid battery applications**
Mr. Doug Bathauer, CEO,
INTEGRAL TECHNOLOGIES, INC., United States

SESSION 6 - MANAGING ESD AND EMI

11:40 **Comparative wear characteristics of stainless steel fiber EMI shielding compounds**
Mr. Ned Bryant, Senior Product Development Engineer,
RTP, United States

12:10 **Utilizing light colored electro-conductive pigments to comply with evolving electrostatic (ESD) standards**
Mr. Jim Stavrakas, Global Product Manager,
MILLIKEN & COMPANY, United States, and
Dr. Philippe Scheerlinck, Senior New Business Development Manager - EMEA,
MILLIKEN & COMPANY, Belgium

12:40-1:40 Lunch

1:40 **Innovative options for controlling static and ESD of plastics: Permanently anti-static block copolymers and multi-wall carbon nanotube masterbatches**
Mr. Patrick Delprat, Graphistrength Business Manager,
ARKEMA SA, France, and
Mr. Nick Deluca, Business Development Engineer - Antistatics,
ARKEMA, United States

SESSION 7 - MEASURING THERMAL CONDUCTIVITY

2:10 **Measurement of thermal conductivity and thermal conductivity anisotropy of wood-plastic composite materials**
Ms. Sarah Ackermann, Applications Specialist,
C-THERM TECHNOLOGIES, Canada

2:40 **Thermal conductivity measurement by steady-state and flash diffusivity methods and instruments**
Dr. Heng Wang, Product Marketing Specialist,
TA INSTRUMENTS-WATERS LLC, United States

3:10 Afternoon wrap up and questions

3:30 Conference ends

Conference bag sponsored by: MDI MODERN DISPERSIONS, INC.

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AMI reserves the right to alter the program without notice.
The latest program can be viewed on our website: ***www.amiplastics-na.com***

Click here for a PDF of the brochure

CONFERENCE DETAILS

DATE AND LOCATION:
September 27-28, 2016
Hilton Philadelphia city Avenue
4200 City Avenue
Philadelphia, PA 19131 USA
Tel: +1 215 879 4000

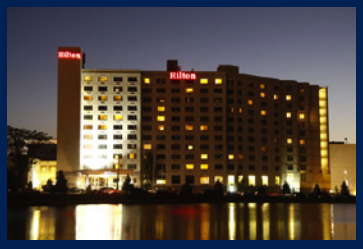

Image courtesy of:
Hilton Philadelphia City Avenue

HOTEL ACCOMMODATION
The conference fee does not include lodging. We have negotiated a special rate of $159 plus tax per night at the Hilton Philadelphia City Avenue. To make a reservation, please contact the hotel's reservation department at +1 800 445 8667 by September 6, 2016 and indicate that you will be attending "AMI's Conductive Plastics 2016 conference" to qualify for the special room rate. The hotel rate is guaranteed for a limited number of rooms so do not delay in making your reservation for a room at the conference location.

REGISTRATION FEE
Register before July 15, 2016 for only $1090. Thereafter the fee will be $1290. Registration includes all sessions, conference proceedings, cocktail reception, luncheons and break refreshments.

GROUP RATES
For companies wishing to register two or more delegates, group discounts are available. Please contact the Conference Coordinator for more details.

SPONSOR THIS EVENT AND PROMOTE YOUR COMPANY
AMI events are more than just arenas for listening and networking. They also represent highly targeted opportunities to enhance your image and promote your products and services to an international audience.

Each event offers the following unique awareness building opportunities: sponsorship of the welcome cocktail reception, lunches, coffee breaks, and much more. For further information please contact the Conference Coordinator at +1 610 478 0800.

EXHIBITION PACKAGE
This package includes an exhibition space in the conference room where we will be hosting registration, the cocktail reception and coffee breaks, giving exhibitors maximum exposure. It also includes 1 free delegate place. Exhibitors may either use tables provided by the hotel or bring their own stand or display. A limited number of tables are available and are assigned on a first come, first serve basis. The cost of this package is $1,990. Please note: When applicable, exhibitors are responsible for any electricity and/or handling fees involved with their booth. For further information please contact the Conference Coordinator.

SOCIAL EVENTS
The social events organized for AMI's Conductive Plastics 2016 will provide an ideal setting for delegates and speakers to mix business with pleasure. On the first evening, everyone is warmly invited to attend the cocktail reception.

SUBSTITUTIONS / CANCELLATIONS
Delegates may be substituted at any time at no charge. We ask that you provide ample notification of substitution in order that materials can be prepared. Full refunds, less an administrative charge of $200 will only be made on cancellations received prior to July 15, 2016. We regret that we cannot make refunds on cancellations received after this date or for no-shows at the conference. Please note that refunds cannot be made on table top bookings or sponsorship packages.

FAX FORM TO: +1 610 478 0900

CONFERENCE HOTLINE

Ms. Kelly Cressman, Conference Coordinator

Applied Market Information LLC
1210 Broadcasting Road, Suite #103
Wyomissing, PA 19610, USA

Tel: +1 610 478 0800
Fax: +1 610 478 0900
Email: kc@amiplastics-na.com

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REGISTRATION FORM

Conductive Plastics
September 27-28, 2016
Hilton Philadelphia city Avenue,
Philadelphia, PA, USA

Company: _____

Address: _____

_____

Tel: _____ Fax: _____

Company activity: _____

Delegate Details

If more than one delegate please photocopy form

Title: _____ First name: _____

Surname: _____

Position: _____

Email: _____

Special dietary requirements: _____

Payment Details

Please make payments in US Dollars ($)

❑	**Delegate fee** (before July 15, 2016)	**$1090**	_____
❑	**Delegate fee** (thereafter)	**$1290**	_____
❑	**Exhibition package** (includes exhibition space and one delegate space)	**$1990**	_____
		Total:	_____

Method of Payment

Payment terms are NET 30

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K2016 is less than three months away and, if you are planning to visit, you need to be making plans now. Fortunately, there are plenty of resources on the web to help you – we highlight some of the most useful over the following two pages

Prepare for your visit to K2016

K2016, the world's biggest plastics takes place in Dusseldorf, Germany on 19-26 October 2016 and the organiser of the show, Messe Dusseldorf, will be hoping to improve on the 218,000 visitors that made it through the doors at K2013.

Once again, the show will fill all 19 halls of the venue – where an expected 3,038 exhibitors from more than 130 different countries will promote their raw materials, additives, semi-finished products, machinery, ancillary equipment and services to the plastics industry.

The plastics and rubber machinery sector has fared well since the 2013 event and that is likely to show through in the exhibits presented to visitors. "The most important thing about K is that all the machines are working and whatever is shown is brand new," says Werner M Dornscheidt, President and CEO of show organiser Messe Dusseldorf.

Meanwhile, the Science Campus research and teaching forum is back with more participants. Intended to encourage dialogue between research and industry, participants include Darmstadt University, the Institute of Polymer Technology (IKT) at the University of Stuttgart, and VDI – the Association of German Engineers. It will focus on four key themes: resource efficiency; new materials; lightweight engineering; and Industry 4.0

Turn the page to see our essential guide to planning your trip to Dusseldorf, with lots of useful links.

FAST FACTS

Dates:	19-26 October 2016
Venue:	Dusseldorf Fairground, Dusseldorf, Germany
Hours:	10:00 to 18:30 daily
Organiser:	Messe Dusseldorf
Website:	www.k-online.de

Buy and print your ticket in advance here to save money and get free use of Dusseldorf's public transport system throughout your stay.

compounding WORLD magazine at K2016

Compounding World will be exhibiting at K2016 on the stand of parent company Applied Market Information (AMI, Stand C11 in Hall 7). Call in to find out more about our digital plastics magazine and apps and to meet some members of the team. It is also the place to go to learn about AMI's latest industry directories, market reports and conferences.

In the run up to the big event, *Compounding World* will be publishing detailed previews of the innovations that will be on show. Look out for our K Preview Issue in September and our K Show Special in October. Our journalists will also be covering the show from start to finish (you can follow the news as it happens on our Twitter feed @Plasticsworld) and we will also be reviewing the event in detail in our November/December edition.

If you are exhibiting at K, then do let us know about the new products you will be showing. Send your press releases to Editor-in-Chief, Chris Smith at cs@amiplastics.com. Full details of our coverage of K can be found in our media pack.

Click for info

Use our hand-picked selection of weblinks to make sure you have a productive and enjoyable visit to K2016

Get K on your smartphone

Lots of useful K 2016 data is now available on your smartphone or tablet, including exhibitor and product databases, exhibition plans, travel information, hotel listings, city guides and restaurant reviews. Download the App for Apple iPads and iPhone here: **http://bit.ly/K16appleapp**

Get the Android version here: **http://bit.ly/K16androidapp**

Buy your tickets

Purchasing your tickets online in advance can save you up to €27. A three-day ticket bought online costs €108 instead of €135 when purchased at the exhibition. One-day tickets are €49 in advance or €65 at the show. Order your tickets now by clicking **here**

Book your hotel

Dusseldorf's hotels quickly fill up for the eight days of K and the best options go early. Find out what's still available and make your reservation as soon as possible at the official **website**

Make the most of Dusseldorf

After a hard day at the show you will have earned some relaxation time. Make the most of your evenings in the city by checking out the restaurants, pubs, bars, culture and entertainment on offer. This official guide has useful listings as well as guides to the sights and neighbourhoods: **http://bit.ly/DusseldorfGuide**. Also worth a look is the Wikitravel page on the city: **http://bit.ly/wikiguide**. And if the Altstadt and its 260 pubs get too crowded, try heading to the Media Harbour for its modern architecture and venues: **http://bit.ly/MediaHarbour**. Dusseldorf's old town (Altstadt) is said to have more than 260 bars so no surprise that many show visitors and exhibitors make their way there in the evening. Find out more **here**.

Organise your travel

Dusseldorf is well connected and getting around the city is easy thanks to its excellent public transport network. And don't forget that your admission ticket for the exhibition allows you to use the local buses and trains for free. Full details of this offer can be found in the Messe Dusseldorf travel guide along with lots of information about travelling to and around the city. It also contains plenty of useful maps. Download the guide from **here**

Check out the exhibitors

With more than 3,000 exhibitors to choose from and a total exhibition area of more than 160,000m², it makes sense to plan your time at the show before you head off. The good news is that you can search for participating companies by name and by product using the daily-updated online K2016 database. To search by company, click **here**. To search by products, click **here**. You can also locate companies using the pdf floorplan which can be found **here**. Finally, you can search through the list of all exhibitors and products, broken down by category **here**

Soak up some culture

Believe it or not, there is more to Dusseldorf than K – it is the capital of North Rhine-Westphalia, after all. The city is home to more than 100 galleries and museums but the biggest by some way is the Museum Kunstpalast, located in the centre of the city near Königsallee. During the fair the Kunstpalast's special events include an exhibition of photographs by Nic Tenwiggenhorn, whose work includes early reportages from Dusseldorf and the Rhineland – as well as an earlier career as an industrial product photographer. Find out more at: **www.smkp.de**

Try the retail experience

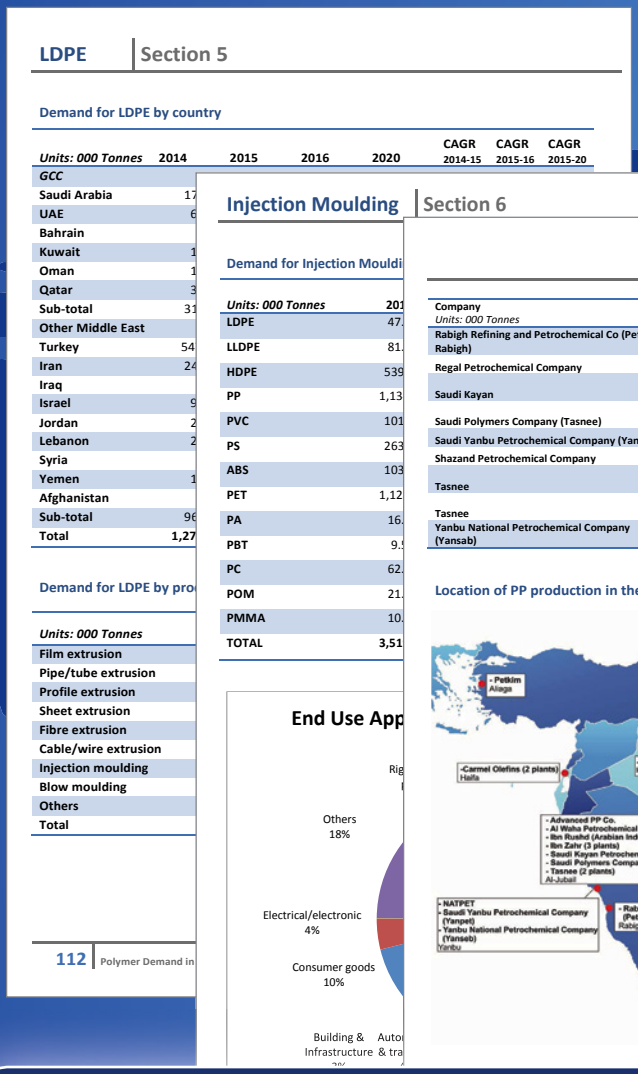
If retail is your thing – and especially designer goods – then Dusseldorf will not disappoint. Königsallee – known as 'Kö' to locals – includes many of Europe's leading fashion names and is likened with Knightsbridge in London or Fifth Avenue in New York. But neither of those locations can boast a setting to match the tree-lined man-made 'river' that runs through this premium shopping district. Catch the flavour here: **http://bit.ly/koenigsallee**

Don't forget the Altbier!

Regular K visitors will already know that Dusseldorf's local brew is the Altbier, a malty copper-coloured ale of around 4.5% strength produced using a special top-fermented lagering method. The name translates as 'old beer' but is actually derived from the Latin word 'altus', which means 'high' and refers to way the yeast rises during brewing. Try it out in one of the city's on-premise brew-pubs. Details of these and a short history of Altbier can be found here: **http://bit.ly/altbier**

POLYMER DEMAND IN THE MIDDLE EAST

An AMI Consulting Data Report



LDPE | Section 5

Demand for LDPE by country

Units: 000 Tonnes	2014	2015	2016	2020	CAGR 2014-15	CAGR 2015-16	CAGR 2015-20
GCC							
Saudi Arabia	17						
UAE	6						
Bahrain							
Kuwait	1						
Oman	1						
Qatar	3						
Sub-total	31						
Other Middle East							
Turkey	54						
Iran	24						
Iraq							
Israel	9						
Jordan	2						
Lebanon	2						
Syria							
Yemen	1						
Afghanistan							
Sub-total	96						
Total	1,27						

Demand for LDPE by pro

Units: 000 Tonnes
Film extrusion
Pipe/tube extrusion
Profile extrusion
Sheet extrusion
Fibre extrusion
Cable/wire extrusion
Injection moulding
Blow moulding
Others
Total

112 | Polymer Demand in

Injection Moulding | Section 6

Demand for Injection Mouldi

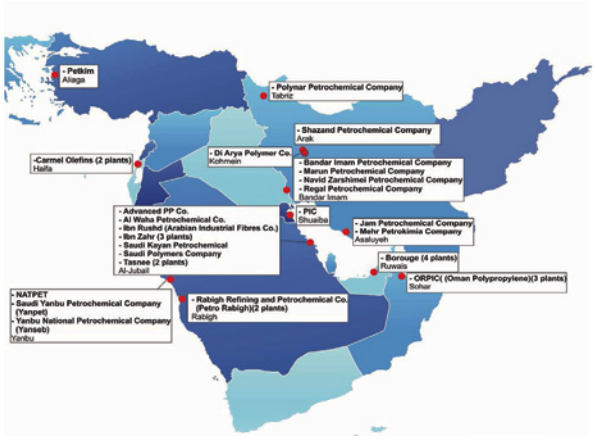
Units: 000 Tonnes	201
LDPE	47.
LLDPE	81.
HDPE	539
PP	1,13
PVC	101
PS	263
ABS	103
PET	1,12
PA	16.
PBT	9.
PC	62.
POM	21.
PMMA	10.
TOTAL	3,51

End Use App

Section 5 | PP

Company Units: 000 Tonnes	Location	Capacity 2015	Capacity 2020
Rabigh Refining and Petrochemical Co (Petro Rabigh)	Rabigh, Makkah Province, Saudi Arabia	350	350
Regal Petrochemical Company	Bandar Imam, Khuzestan, Iran	150	150
Saudi Kayan	Jubail Industrial City, Al Jubail, Saudi Arabia	350	350
Saudi Polymers Company (Tasnee)	Jubail Industrial City, Al Jubail, Saudi Arabia	400	400
Saudi Yanbu Petrochemical Company (Yanpet II)	Yanbu Al Sinaiyeh, Yanbu, Saudi Arabia	260	260
Shazand Petrochemical Company	Shazand, Arak, Iran	75	75
Tasnee	Jubail Industrial City, Al Jubail, Saudi Arabia	270	270
Tasnee	Jubail Industrial City, Al Jubail, Saudi Arabia	450	450
Yanbu National Petrochemical Company (Yansab)	Yanbu Al Sinaiyeh, Yanbu, Saudi Arabia	450	450

Location of PP production in the Middle East



Published: February 2016 This brand new report draws on AMI Consulting's unique, in-depth knowledge and understanding of the downstream plastics processing value chain and provides unrivalled detail in quantifying the volume of polymer materials used across all the major plastics processing technologies on a country-by-country basis.

Also available in the data report series:

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The global plastics industry specialists

Looking ahead to Compounding World Asia 2016

Singapore will definitely be the place to be next month. Just days after it hosts the iconic adrenalin-fuelled night-time Singapore Grand Prix Formula 1 race, large numbers of leading compounding industry experts will descend on the city for two days of productive networking and insightful presentations on the latest business and technology developments.

AMI and *Compounding World* magazine are once again teaming up to hold the second edition of their Compounding World Asia conference on 22 to 23 September 2016 at the Grand Copthorne Waterfront Hotel, Singapore.

Last year's edition attracted 130 participants from 22 different countries and with the 2016 program containing an international line-up of expert speakers we look forward to hosting another lively and productive event.

Covering a diverse range of topics from market opportunities to production efficiency, the conference will be beneficial to all involved in the compounding supply chain.

Over the following pages we preview this year's line-up of speakers and the hot topics that they will be covering.

The Compounding World Asia conference returns to Singapore next month. We preview the packed programme of high-level presentations

Exploring business opportunities

Opening the conference will be **John Nash**, head of strategic research at **AMI Consulting**. With over 30 years experience in the global plastics industry covering sales, marketing, strategy appraisal, due diligence and business management, he is well placed to analyse the key trends in the global plastics market and the growing importance of Asia's compounding industry. He will provide his overview of the current market, setting the scene for the rest of the conference and the discussions that will follow.

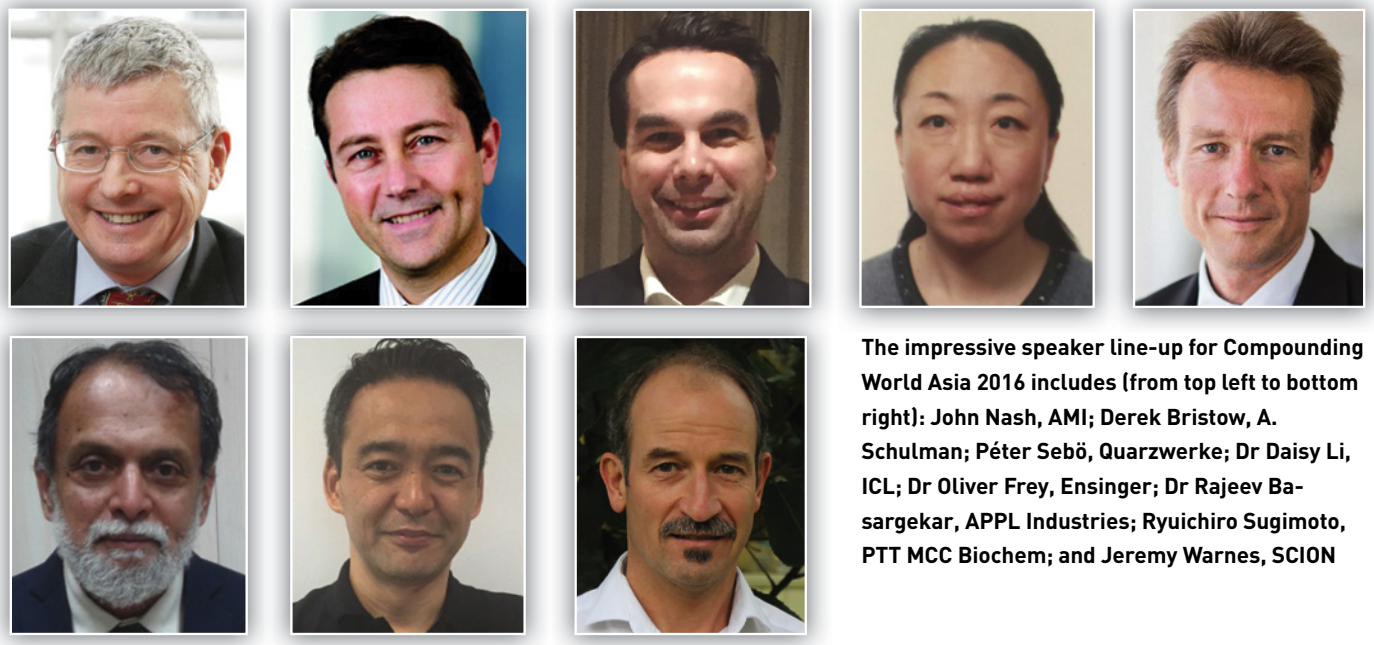
The opening paper will be followed by a panel of industry leaders discussing opportunities and strategies for growing a profitable compounding business in Asia. The panel discussion will cover developing new markets, maximising margins and improving sustainability in the context of the Asian market.

The selection of experts on the panel will include **Derek Bristow**, who is senior vice president and general manager, Asia Pacific at **A. Schulman**, the global supplier of high-performance compounds and resins with over 30 manufacturing sites worldwide. Bristow has over 25 years experience in the global polymer industry and has been with A. Schulman since 2010, responsible for business development in the Asia Pacific region.

Adding value to thermoplastics

The second session of the conference will focus on adding functionality and value to thermoplastics, and the first two papers will cover the hot topics of increasing the electrical and thermal conductivity of plastics.

Main image: The Compounding World Asia conference returns to the vibrant city state of Singapore next month



The impressive speaker line-up for Compounding World Asia 2016 includes (from top left to bottom right): John Nash, AMI; Derek Bristow, A. Schulman; Péter Sebö, Quarzwerke; Dr Daisy Li, ICL; Dr Oliver Frey, Ensinger; Dr Rajeev Basargekar, APPL Industries; Ryuichiro Sugimoto, PTT MCC Biochem; and Jeremy Warnes, SCION

Opening the session will be **Jukka Hillberg**, chief technology officer of **IonPhasE**, the Finland-based producer of inherently dissipative polymers. His presentation will look at the main characteristics of such materials and discuss how they can be used in plastics for static control applications.

Péter Sebö, market development manager at **Quarzwerke**, Germany, will then focus on mineral fillers for increasing the thermal conductivity of plastics materials. He will present a new generation of additives for increasing the thermal conductivity of plastics while maintaining good mechanical and flow properties.

The final paper before lunch will be on the critically important topic of flame retardants. It will be presented by **Dr Daisy Li**, who is technical manager at **ICL**, based at the Chinese offices of the global flame retardants producer. She will talk about a new methodology for the systematic assessment of flame retardants.

Developing compounds for new applications

The afternoon sessions on the first day of the Compounding World Asia conference will focus on formulating compounds for new applications and markets, including new developments for the automotive and electronic industries.

Dr Oliver Frey, head of the compounding department at the German technical compounder **Ensinger**, will start the session with a paper on new high-temperature compound materials for moulded interconnected devices. He will discuss the challenges and solutions in designing compound materials for this type of application which involves the injection moulding of components with integrated electronic circuit traces.

Dr Rajeev Basargekar, technical director at the Indian technical compounder **APPL Industries** will then give a presentation on developing high-performance compounds and alloys for automotive applications. He has spent 18 years in the automotive industry, focusing on R&D and business development of polymers and compounds.

The final paper of the session will shift attention to the growing market opportunities for bio-based materials. It will be presented by **Ryuichiro Sugimoto**, president of **PTT MCC Biochem** of Thailand. He will cover the use of BioPBS to improve the service temperature and impact strength of bioplastic compounds.

Optimising reinforced compounds

The final session on the first day of the conference will feature three presentations on different aspects of fibre-reinforced plastics compounds.

The first talk will focus on the growing market for natural fibre reinforcements. It will be given by **Jeremy Warnes**, who is business development manager at **SCION**, the New Zealand Crown Research Institute that specialises in the research and development of wood-derived materials. His paper will focus on how compounders can unlock the potential of natural fibre reinforcements.

The next presentation will switch attention to high-performance carbon fibre reinforcements which are becoming more cost-effective for thermoplastics applications. **Philip Chu**, a lead chemist at **Zoltek/Toray** in the United States, will deliver an in-depth analysis of the effects that different fibre loadings can have in carbon-fibre-reinforced polypropylene compounds.

The final paper of the first day will examine the production of medium-length-fibre-reinforced polypro-

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The speaker line-up for Compounding World Asia 2016 also includes (from from top left to bottom right): Philip Chu, Zoltek/Toray; P B Raman, Steer Engineering; Dr Thomas Winkelmann, KraussMaffei Berstorff; Michele Fona, Penta; Adam Dreiblatt, CPM Century Extrusion; Manfred Wiedmann, Coperion; Klaus Arlandt, Maag Automatik; and Holger Lieder, Sikora

pylene compounds for automotive parts. It will be given by **P B Raman**, representing **Steer Engineering**, the Indian-headquartered producer of twin-screw compounding extruders. He will look in detail at the process, benefits and drivers for change within this segment of the market.

The opening day of the conference will conclude with a **cocktail reception** providing more networking opportunities in the exhibition area.

Advances in stabilisation

The second day of the Compounding World Asia conference will get underway with a session featuring two interesting papers from leaders in polymer stabilisation technology.

Gregor Huber, head of **BASF**'s Global Competence Center for Automotive will open this session with a presentation on the important subject of light stabilisation for automotive compounds.

He will be followed by **Dr Baburaj Iyer**, regional technical service - India & SEA, **Songwon Speciality Chemicals**. His paper will review how an understanding of stabiliser interaction and access to the necessary additive building blocks can help with the design of new and improved stabilization systems for polyolefins.

Making the most of compounding lines

The penultimate session at the conference will explore the specification and optimisation of compounding lines, covering the latest twin-screw extruders and materials handling systems.

Dr Thomas Winkelmann, head of department plastics technology at the German machinery maker **KraussMaffei Berstorff** will address the big question of whether torque or volume is more important in twin-screw compounding lines.

Michele Fona, sales area manager for the European materials handling systems specialist **Penta**, will continue the session with a talk about the wide variety of polymeric materials that today's compounders have to handle and discuss the sustainable solutions for handling these materials.

Next up will be **Adam Dreiblatt**, who is director of process technology at **CPM Century Extrusion** which manufactures twin-screw extruders in the USA and in China via its Ruiya Extrusion subsidiary. He will focus on the different factors that have to be considered when determining the size of a twin-screw extruder to achieve a desired capacity target.

Leading twin-screw extruder maker **Coperion** will be represented at the conference by **Manfred Wiedmann**, who heads up its business unit for compounding plants, plastics processing plants and packaging lines. He will discuss highly flexible and efficient compounding lines for small lots and quick product changes.

The session will conclude with a presentation on the relative pros and cons of strand pelletizing lines compared with underwater pelletizing systems. It will be delivered by **Klaus Arlandt**, who is sales manager Asia for **Maag Automatik**, which has extensive experience in both types of pelletizing systems, especially following its recent acquisitions of Gala and Reduction Engineering Scheer.

Improving control and monitoring

The final session of the conference will focus on the latest technologies for improving the control and monitoring of plastics compounding lines. It will open

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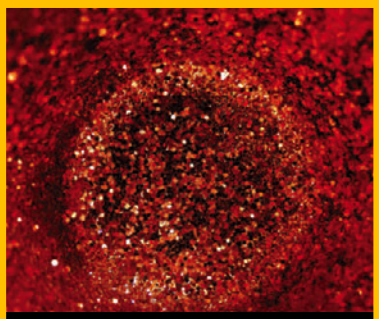

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The Compounding World Asia conference takes place in Singapore just four days after the F1 Grand Prix

with a talk on the hot topic of Industry 4.0 and how this can be applied to large-scale polypropylene compounding. **Sven Wolf**, managing director at the German twin-screw extruder specialist **Leistritz Extrusionstechnik** will discuss the innovative application, which involves inline MFI closed-loop control measurement

Closing the conference will be **Holger Lieder**, who is sales director at **Sikora** of Germany. He'll conclude proceedings with a talk about new technologies to inspect and improve plastics pellet quality, both on-line and off-line.

Exhibition and networking

The Compounding World Asia 2016 conference will feature an exhibition area for networking during the coffee and tea breaks, the lunches and the evening cocktail reception. It will feature an array of industry suppliers covering additives, machinery and equipment (please note that the exhibition will only be open to conference delegates and speakers).

Exhibitors that have already signed up at the time of writing include: Buss; CPM Century Extrusion; Dr. Collin; ICL; KraussMaffei Berstorff; Leistritz; Maag Automatik; Nordson Polymer Processing Systems; Penta; PTT MCC Biochem; Quarzwerke; and Steer.

AMI will also be showing its latest industry guides in the exhibition area. These will include its brand new 2016 database of ***Compounders and Masterbatch Producers in China*** which contains details of 600 companies. Delegates will receive a 20% discount on all AMI products ordered at the conference.

Further Information

The **Compounding World Asia 2016** conference is organised by AMI and *Compounding World* magazine, and it is sponsored by Penta, Steer, Leistritz, Coperion, and Songwon. It is taking place in Singapore on 22-23 September 2016.

For more information about participating in the Compounding World Asia event as a delegate, exhibitor or sponsor, please contact the conference organiser Giulia Esposito at **ge@amiplastics.com**, tel: +44 (0)117 314 8111. You can also view the complete conference programme along with booking details in the brochure at: **http://bit.ly/CWA2016P**

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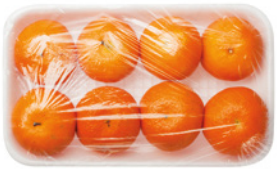

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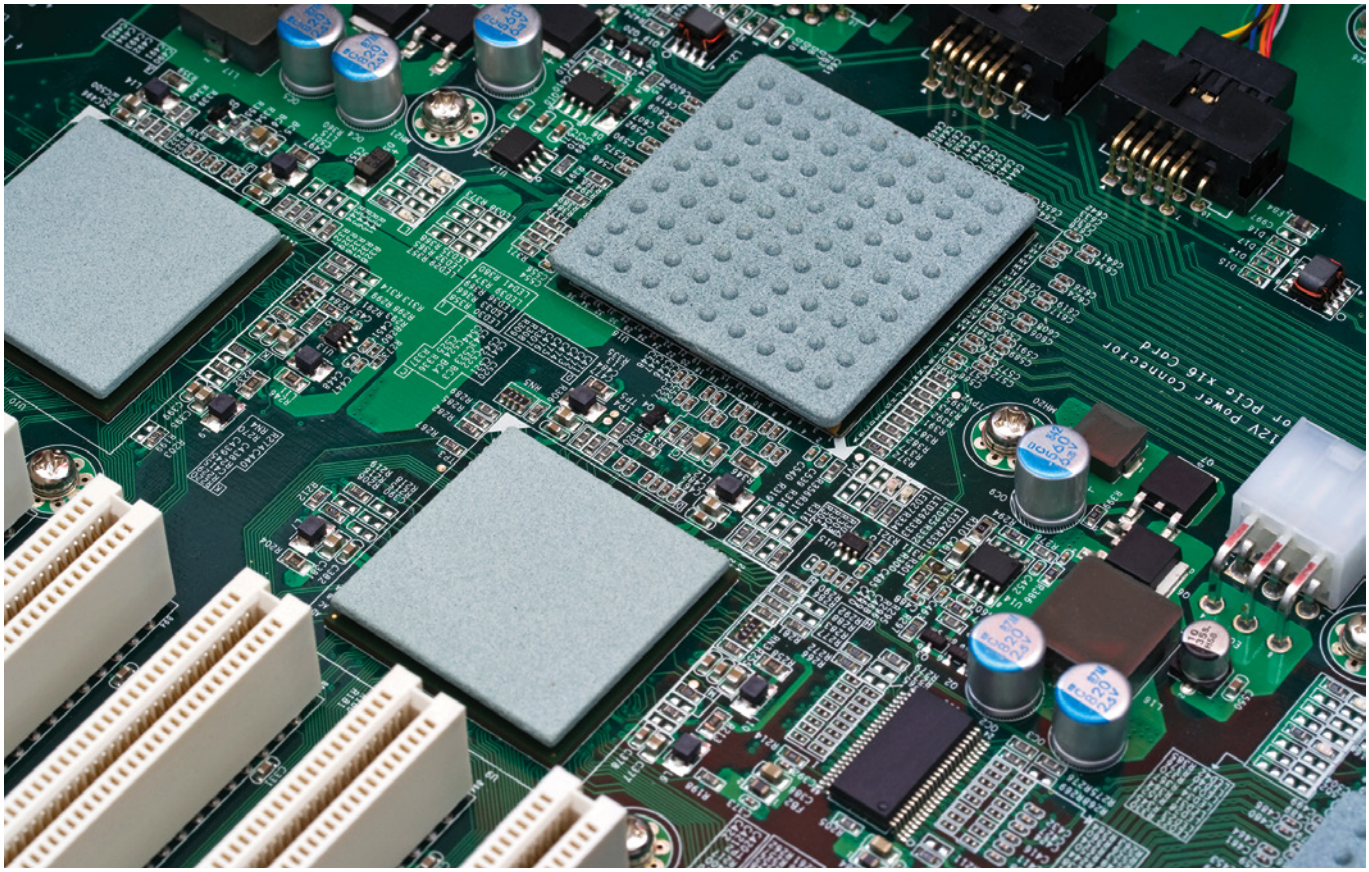


E&E proves a hot spot for plastics

New materials and process technologies dedicated to the fast-growing market for LED lighting dominate polymer innovation in the electrical and electronics arena, particularly in the area of thermal management, which is driving development of thermally conductive compounds. However, integration is also a key demand and a recently announced process for producing components that combine the functionality of electrical circuitry and heat sink is also close to being used in commercial applications, while plastics compounds containing electrically conductive fillers to provide electromagnetic shielding are gaining ground too. This article takes a look at some of the latest innovations.

While the fast growing LED market certainly grabs the headlines there are many more polymer-based innovations to be found in the electrical and electronics sector. Peter Mapleston reports

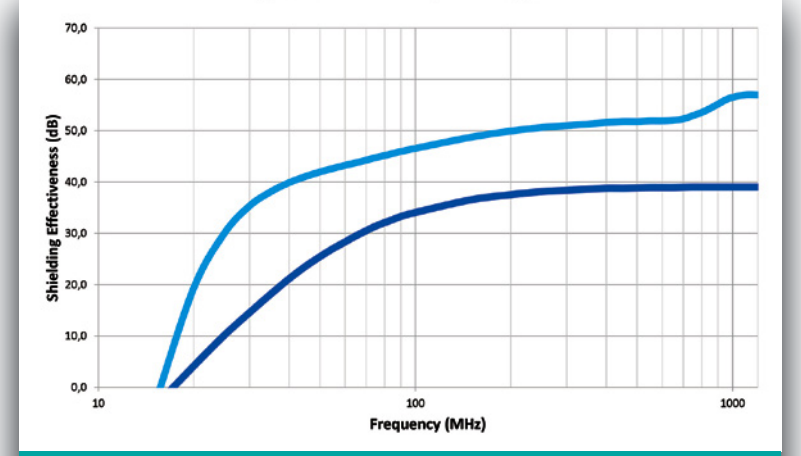
Shielding solutions

Luvocom ES is the latest generation of thermoplastic shielding compounds from **Lehmann & Voss**. The compounds contain metal fibres in combination with other additives, says Thomas Collet, global product and marketing manager for the company's Customized Polymer Materials business unit. Rheology is optimised for easy processing and thin walls. "This results in a much lower risk of defects in moulded parts due to imperfectly distributed fillers in comparison to polymers and masterbatches that have been dry blended at the injection moulding machine," Collet says.

Overall shrinkage, flow and mechanical properties for some Luvocom ES compounds are close to standard PC/ABS with 20% glass fibres and parts are said to have an "attractive" surface appearance. Flame retardant packages can also be included.

Another major compounder, **RTP Company**, says it has noted an increased interest from the electronics market for engineered compounds that provide both thermal conductivity and EMI shielding properties. Neil Hardwick, within the company's Conductive Products

Main image: Many components on electronic circuit boards require plastics with high heat resistance, says Nilit Plastics



Screening effectiveness of a conductive Lehmann & Voss compound based on PA6 at 3mm (top line) and 2mm thickness

Marketing team, says interest in thermally conductive plastic compounds is being driven by demand for Wi-Fi capability in consumer and industrial devices. Metal heat sinks block Wi-Fi signals, he says, and even plastics that are modified with carbon fibre or graphite can introduce enough electrical conductivity to interfere with wireless communication signals. Non-conducting plastics housings tend to cause overheating in the latest small devices. RTP has developed thermally conductive compounds containing ceramic fillers that are transparent to Wi-Fi signals.

Hardwick also says that interest in replacing metal housings with plastics ones providing EMI shielding continues to increase, not only for weight-saving and design flexibility reasons but also because injection moulds last much longer than metal casting moulds. "By utilising continuous stainless steel fibres in long fibre compounding processing, RTP Company can deliver EMI shielding at a similar level as cast or sheet metal," he says.

Optimised transmission

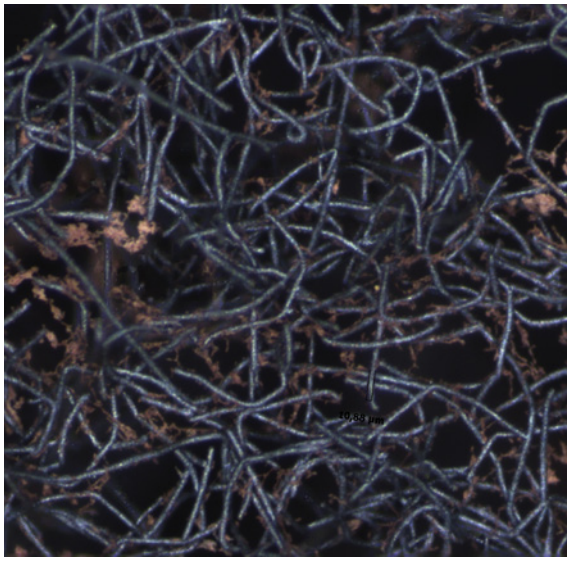
SABIC recently announced a new portfolio of Thermocomp compounds developed for use in phase shift components housed within local Wi-Fi antenna base stations. Base stations include multiple antennas containing phase shifters which, based on traffic, deliver either greater strength to reduce dropped transmissions or greater range to broaden coverage.

The range of new materials has been optimised for transmission conditions from 900 MHz to 3GHz and beyond, providing different combinations of Dk (dielectric constant, which quantifies signal range) and Df (dielectric dissipation factor, which indicates signal loss). In addition, the Thermocomp compounds offer improved dimensional stability and durability, lower friction and increased flame resistance, as well as more design freedom than ceramics or PCBs normally used.

"The explosive growth of smart devices, mobile-to-mobile connected modules and the ever-increasing amounts of data and voice traffic generated by their use are key drivers in the need to expand global network and transmission capacity," SABIC says.

The dielectric performance requirements are slightly different at various frequencies from 900 MHz to 3GHz, and at different temperature ranges. "We found that the industry lacked performance-specific materials," says Alan Tsai, director of consumer electronics technology and innovation in SABIC's Innovative Plastics operation. "This is why we took on the challenge of providing new options."

The new SABIC materials are said to provide a better balance of dielectric properties than ceramics or PCBs, with extremely low Df, down to 0.001, and a wide range of Dk from 3 to 13.9, depending on frequency requirements. By comparison, the lowest achievable Df with general purpose PCBs is around 0.005. SABIC's dielectric portfolio consists of compounds using a variety of base resins, ranging from Lexan polycarbonate, through Noryl modified polyphenylene ether, to high density polyethylene.



Right: Photomicrograph of Luvocom ES shielding compound showing the metal fibre content

Comparison of various SABIC solutions for base station antenna phase shifter components

	Thermocomp ZX06323	Thermocomp ZX08309	Thermocomp DX09309	Thermocomp ZX08005	Thermocomp FX10009
Dk (dielectric constant)	6.4@1.1GHZ	4.5@1.1GHz	8@1.1GHz	6.16@1GHz	13.9@3GHz
Df (dissipation factor)	0.004@1.1GHZ	0.003@1.1GHZ	0.010@1.1GHz	0.001@1GHz	0.005@3GHz

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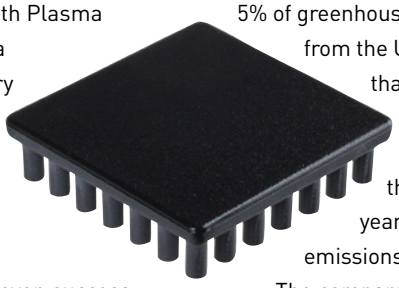
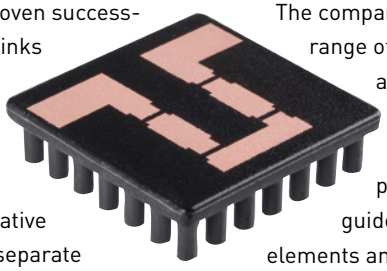
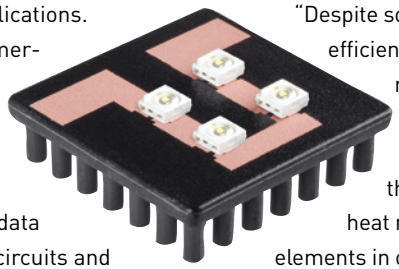
Above: Stainless steel fibres go into electrically conductive long fibre filled compounds at RTP Company

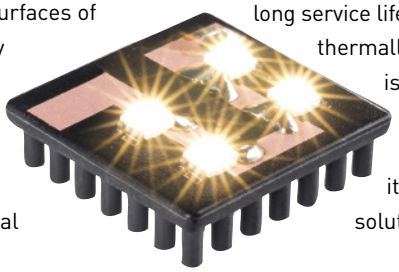
Integration technology

At the Fakuma exhibition in Friedrichshafen, Germany, last year, **PolyOne** presented an update to the new manufacturing technology it highlighted during Fakuma 2014 for production of 3D-MIDs (three dimensional moulded interconnect devices) with integral heat sinks. PolyOne collaborated on the project with Plasma Innovations, which developed a plasma treatment process that creates circuitry without the need for galvanization prior to metallization, as well as with LPKF, a specialist in equipment for creating circuits on injection moulded parts using laser structuring.









Right: Individual production stages in the Plasma Innovations' Digital Direct Metallization process for creation of metallic circuits on polymer substrates, developed with PolyOne

PolyOne says the technology has proven successful in production of LED lighting heat sinks with integrated electrical circuitry, largely due to the thermally conductive properties of its Therma-Tech thermally conductive compounds. It says the concept could prove an alternative to complex printed circuit boards and separate heat sinks currently used in these applications. Plasma Innovations expects first commercial use of the process to begin around the end of this year.

Plasma Innovations' Digital Direct Metallization (DDM, previously known as Plasmacoat 3D) makes use of CAD data to enable the metallization of electric circuits and conductors directly inline and on the surfaces of various materials. This means that any changes to circuitry require modifications only to software. Instead of wet chemical or electro plating processes, DDM builds the electric circuits with a laser and plasma-activated metal powders layer by layer. Various specifically-developed DDM powders are available for the process.

Production of LEDs with integral heat sinks and circuitry involves several steps: injection moulding of the part, screen printing of a mask, laser structuring of the pattern to be metallized for the circuitry, plasma coating of the metal, cleaning, and finally attachment of the LED chips using surface mount technology. Compared with traditional processes, total system cost can be as much as 30% less expensive, it is claimed.

According to consultant **Strategies Unlimited**, the LED luminaire market is likely to grow at around 12% annually through to at least 2018. PolyOne believes that producers in this fast growing market can obtain massive cost savings by switching to engineering plastics for lenses (already well under way), reflectors, housings and heat sinks (see Figure 1).

LED developments

Covestro, the company previously known as Bayer MaterialScience, notes that lighting currently accounts for around 15% of the world's energy consumption and 5% of greenhouse gas emissions. It quotes estimates from the UNEP Global Efficient Lighting Forum that indicate switching to energy-efficient lighting could reduce this worldwide energy requirement by more than one thousand terawatt hours (TWh) each year, thus reducing the associated CO_2 emissions by roughly 530m tonnes.

The company has established a wide and diverse range of polycarbonate-based products (sheet and film as well as injection moulding compounds) for energy-efficient LED lighting. It is pitching its Makrolon products at lenses and optics, light guides, diffusers, reflectors, cooling elements and housings.

"Despite some improvement with respect to the efficiency of LEDs, the lamps have still not yet reached the level of efficiency theoretically possible because a portion of the energy is given off in the form of heat," Covestro says. "This heat must be dissipated via cooling elements in order to ensure a high light yield and long service life of the lamps." The company's thermally conductive Makrolon TC8030 grade is pitched at these applications. It has thermal conductivity similar to that of aluminium, but its lower density suits it to lighter-weight LED lighting solutions. Covestro says more thermally

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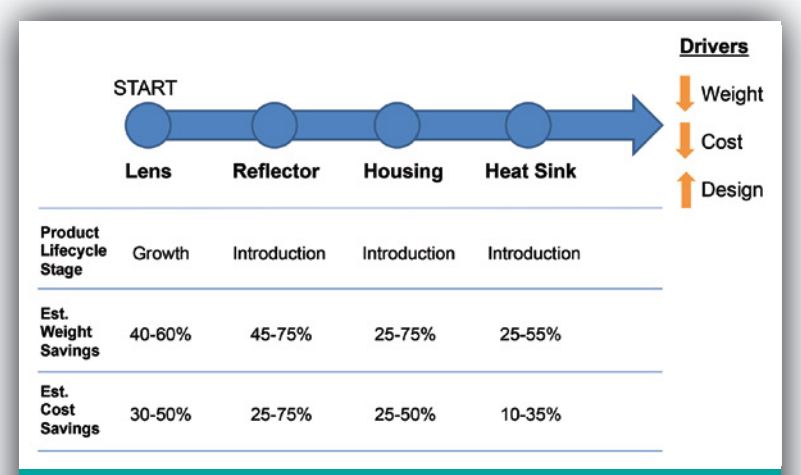


Product Lifecycle Stage	Growth	Introduction	Introduction	Introduction
Est. Weight Savings	40-60%	45-75%	25-75%	25-55%
Est. Cost Savings	30-50%	25-75%	25-50%	10-35%

Figure 1: LED Luminaire polymer conversion roadmap
Source: PolyOne

conductive Makrolon grades are set to be launched soon.

Numerous polymer producers, as well as compounders, are in fact taking an increasing interest in the market for thermally conductive compounds. In late 2014, for example, **Celanese** acquired the assets of **Cool Polymers**, a leading US compounder of conductive polymers with strong technical capabilities in the LED market. **Solvay Engineering Plastics** is also readying a range of thermally conductive polyamide compounds, set for launch ahead of the next K show. "We see good prospects for these types of materials, and not just in LEDs, they are branching out into other areas," says James Mitchell, global director for the E&E market.

USB connections

DSM is currently putting a strong emphasis on the suitability of its high temperature polyamides for very demanding applications in electronics. It says that its Stanyl PA46 and Stanyl ForTii PA4T have been approved by numerous global producers for use in the next generation of USB Type-C connectors. It says they answer the need for improved levels of safety and reliability.

USB (Universal Serial Bus) is the industry bus standard for transferring data and power to and from digital devices. Device charging over USB has become a major consumer feature in recent years. But even though it is a standard, there are numerous types of USB plugs and sockets. The electronics industry has come under considerable pressure to develop a standardised charging interface, so that one charger and its associated cable can be used for multiple devices. As a result, the USB Type-C connector will be obligatory from 2017. Several electronics OEMs have already launched equipment that incorporates Type-C ports.

The Type-C connector has a reversible design allowing it to function perfectly whether it is plugged in right-side up or upside down. In addition, the plugs at both ends of a cable are the same. Moreover, with wall thicknesses at only 25% of previous generation connectors, they are much smaller.

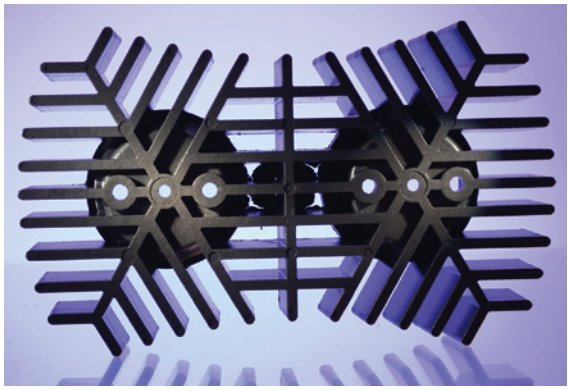
With USB Type C connectors being so small, the performance properties of the materials used for their housings are especially critical. Stanyl (polyamide 46) and Stanyl ForTii (polyamide 4T) have CTI (Comparative Tracking Index) ratings well above 400V, a measure of their ability to provide electrical insulation. DSM says that connectors in alternative materials such as LCPs and even some rival high performance polyamides short circuit during CTI testing, resulting in a serious performance and safety issue for the complete device. It claims its materials do not.

Stanyl and Stanyl ForTii can be used to produce connectors with wall thicknesses as thin as 0.12 mm and which still have the required high mechanical properties. Their high flow in combination with high weld-line strength ensures the required high pin pull-out strength—the force needed to pull metal contacts out of the housing— and parts successfully pass durability tests that involve mating and unmating plugs and sockets more than 10,000 times.

USB Type-C connectors are extremely complicated assemblies of plastics and metal. Different producers are considering slightly different manufacturing routes, but one favored option, at least for the socket, is to use a process that involves sequential insert moulding. A "preform" is first made, which has a set of contacts embedded in it, and then this is used in a second insert moulding process in which additional metal components are incorporated into the assembly.

With two-stage insert moulding, it is advisable to use a thermoplastic in the first stage that has a melting point higher than that used in the second stage, to ensure that no remelting occurs that could cause the first set of inserts to shift position. But the second material still needs to have a melting point high enough to resist the temperatures involved in any possible subsequent high temperature soldering process.

DSM says that an ideal solution is to use PA 4T for



Right: Covestro says its thermally conductive Makrolon TC8030 PC grade provides good thermal management in LED components such as heat sinks

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the first insert molding stage; this has a melting point of 325°C. The second insert molding stage can then be done with PA 46, which has a melting point of 295°C.

Tackling corrosion

Solvay Engineering Plastics is readying a second generation of Technyl One, which the company introduced at K 2013. Technyl One technology is billed as providing high temperature performance and superior electrical properties compared to traditional high performance plastics, with low corrosion for improved tool life and high flow. Formulated to outperform standard PA66 grades, target applications include high-range mini circuit breakers, moulded case circuit breakers and contactors, as well as automotive sensors. A full range of products includes grades with reinforcement levels up to 50% and different stabilisation packages, as well as some colours.

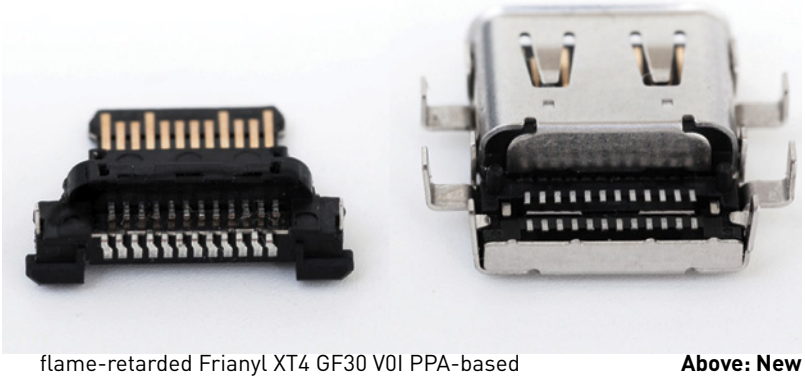
The next generation, set for introduction at K 2016, will have even better properties in terms of corrosivity and extractables, according to Mitchell. "Independent tests at the Fraunhofer Institute have shown that Technyl One is well ahead of the competition in terms of corrosion, but we want to go one step further and take it to the absolute minimum," he says.

BASF is also focusing on low corrosivity. It highlights its Ultramid A3U42G6 polyamide 66 compound, which meets UL 94 V-0 requirements at wall thicknesses as low as 0.4 mm. The grade can be moulded in light colours and processes easily with low deposit formation and corrosivity, says the company. "Its thermal ageing resistance has been considerably improved over that of well-known glass fibre-filled polyamide grades," it says. With an RTI for dielectric strength (UL 746B) of 140 °C at a wall thickness of 0.4 mm and 150 °C at thicknesses starting at 0.75 mm, the grade is said to be especially well suited for use at higher temperatures.

BASF also says that for applications requiring a yellow card according to UL94, it now offers new optimised products of Ultramid B3S polyamide 6 with the suffix "R03". These grades are listed V-2 for wall thicknesses of 0.75 mm and higher. The specifications remain the same as the existing Ultramid B3S grades.

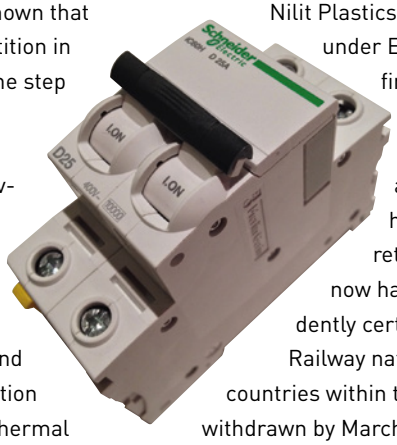
Flame concerns

Major polyamide compounder **Nilit Plastics** says it is responding to E&E trends and industry needs with a variety of product developments that span not only standard polyamides (6 and 66) but also polyphthalamide (PPA), which it has offered since 2014. It cites its flame-retarded Frianyl XT4 GF30 V0I PPA-based compound, which achieves UL 94 V-0 certification for all colours at thicknesses down to 0.4 mm.



Above: New small USB Type-C connectors put very high demands on internal plastic components, says DSM

Nilit says this new grade responds to trends in miniaturisation as well as safety and temperature increases in processing and final use, and incorporates halogen-free flame retardants. Arno Wolf, vice president for sales at Nilit Plastics Europe also points out that customers in the E&E industry have full freedom to colour-code and colour-brand their applications using the PPA compound.



Left: Schneider Electric is a user of Solvay's Technyl One for circuit breakers

Nilit Plastics also highlights the certification under EN 45545-2, the new pan-European fire protection standard for railway passenger vehicles, it has just achieved for Frianyl A3 H GF25 V0, a PA66 30% glass fibre reinforced, heat stabilised and V-0 flame retardant compound. The company now has seven grades of Frianyl independently certified to comply with EN 45545. Railway national standards operated by countries within the European Union will have to be withdrawn by March 2016 at the very latest and all materials used in passenger carriages will have to be compliant with EN 45545.

Under EN 45545, materials are given one of three "hazard level" classifications: HL1, HL2 and HL3 (the highest), depending on their Limiting Oxygen Index (LOI), the density of smoke they generate and the toxicity of any gas they produce. Nilit has one PA6 and four PA 66 compounds rated HL3. They include varying levels of glass reinforcement, ranging from zero to 30%. The company also has also two compounds rated HL2.

Cost optimisation

Lanxess has a developed a cost-optimised polyamide 6 for substitution of mineral-filled polyamides. Durethan BKV 25 FN27 flame-retardant polyamide 6, is said to offer improved performance at a comparable price. "It also features isotropic shrinkage, but is stiffer and stronger, can be freely coloured, and is easier to weld using ultrasound," says Alexander Radeck, application

development expert in the Lanxess High Performance Materials business unit.

A potential application for the new Durethan BKV 25 FN27 grade is low voltage switching equipment. In the glow-wire test (IEC 60695-2-12), samples of the halogen- and phosphorus-free material achieved a Glow Wire Test-rating on a finished part of 960°C at thicknesses of less than one millimetre — the highest achievable rating for plastics.

The company also offers Durethan BG 30 X F30 and Durethan BG 30 X FN01 very low distortion grades, which are reinforced with glass microspheres. The latter is a halogen-free flame-retardant plastic boasting a UL f1 listing for use in outdoor applications exposed to UV light and water.

Lanxess says its reinforced, flame-retardant polyamide and PBT compounds, which also exhibit a low tendency to warp, are in particular demand for the manufacture of geometrically intricate and large housing parts. The company claims that with its Pocan AF, it is one of the few suppliers of PBT/ASA (acrylonitrile-styrene-acrylate) blends that fit the requirements. "They produce outstanding surfaces, and leave hardly any deposits in the injection mould," says Radeck. Grades are rated V-0 according to the UL94 flammability test.

Moving on PBT

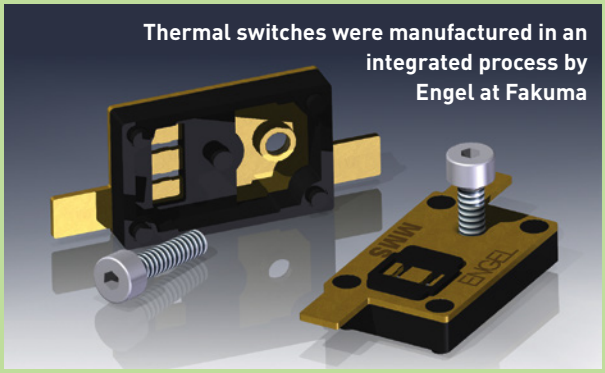
Solvay Engineering Plastics is also planning to enter the PBT compounds market shortly. It already has limited production of PBT compounds in Korea for local customers, but market director James Mitchell says the plan is to take a more global position and to also transfer its expertise in halogen-free flame retardant technology for polyamides across into PBTs.

In many markets, especially in Asia, standard polyamides and PBT go head-to-head for applications such as connectors. On the one hand, PBT can be more cost competitive and it has been progressively increasing market share; but on the other, technology for producing halogen-free flame retardant grades is generally more advanced in polyamides than it is in PBT.

BASF says its Ultradur B4450 G5 halogen-free

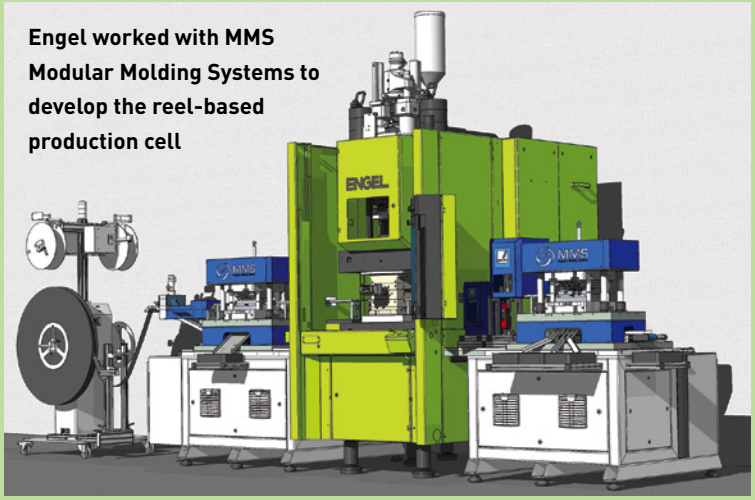
Automated thermal switch production

At Fakuma 2015 in Friedrichshafen, Germany, last autumn, Engel demonstrated a highly integrated, fully automated process for manufacturing, testing and labelling thermal switch housings produced by over-moulding metal (brass) components that are stamped from a reel in the cell itself. The core of the production cell is an Engel insert 60V/35 single vertical machine. Also included in the cell is a processing module for tapping a thread into the component.



Thermal switches were manufactured in an integrated process by Engel at Fakuma

Thermal switches, used for electric motors in cars, domestic appliances and elsewhere, are normally produced in a complex multiple stage process, with the metal components being punched and over-moulded at different locations. Engel says the savings potential through process integration and simplification of logistics is high. It created its system solution in collaboration with fellow Austrian company MMS Modular Molding Systems. "It guarantees the lowest possible unit costs and makes composite manufacturing economical even at locations with high wage levels," Engel claims.



Engel worked with MMS Modular Molding Systems to develop the reel-based production cell

The brass carrier plates are overmoulded with a glass fibre reinforced polyamide. Quality inspection occurs directly after moulding. In addition to camera-based checks, high voltage testing for short circuits is carried out on every part. Parts that pass the test are immediately laser marked to ensure complete traceability. Eight ready to install parts leave the production cell every 20 seconds. The modular design of the MMS systems makes it possible to integrate additional processing modules, for example for resistance or laser welding, riveting, assembly or cleaning of the parts. The entire process is visualised and controlled via the CC300 control unit on the Engel injection moulding machine.

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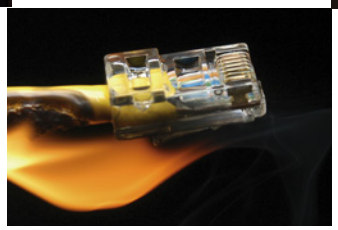


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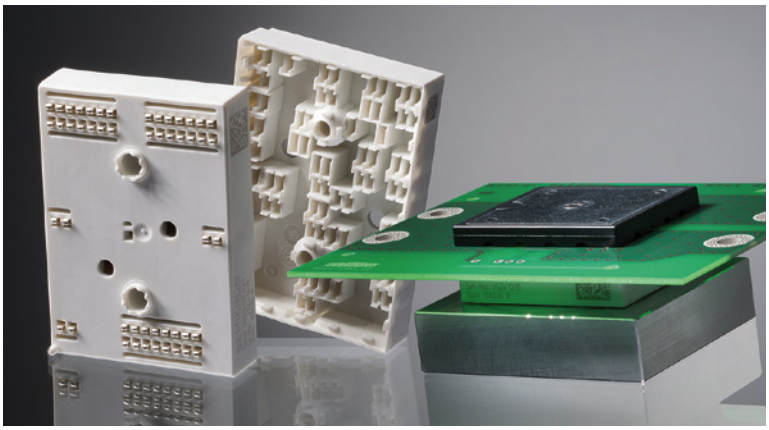
flame-retardant PBT is now being used in the mass production of the "MiniSKiiP Dual" power semiconductor modules from Semikron. Examples of uses of these modules, also known as DC/AC converters, are found in industrial drive technology, solar inverters, and in the powertrain of electric vehicles. The housings protect the power semiconductors from external influences such as moisture, dirt, and fluctuations in temperature.

The Ultradur B4450 G5 material is classified as V-0 from a wall thickness of 1.5 mm. BASF says this makes it particularly well suited to applications in electrical power modules which are subject to a high amount of heat generation. Its CTI value of 600 V also indicates very good electrical insulation capacity.

"We have managed to manufacture components which are not just extremely stable, but also display a very low level of wear for a material that is reinforced with glass fibres," says Jörn Grossmann, new technologies material expert at Semikron.

Click on the links for more information:

- **www.lehvoss.de**
- **www.rtpcompany.com**
- **www.sabic.com**
- **www.polyone.com**
- **www.strategies-u.com**
- **www.covestro.com**
- **www.celanese.com**
- **www.solvay.com**
- **www.dsmep.com**
- **www.basf.com**
- **www.nilit.com/plastics**
- **www.lanxess.com**



Above: Power semiconductor modules made in BASF's Ultradur PBT by Semikron

The Global Plastics Industry Seminar

A strategic review of the prospects for the global plastics industry

CLICK HERE FOR DETAILS

2016

Seminar dates and locations

27 September	*2016*	*Dubai*	*UAE*
18 October	*2016*	*Cologne*	*Germany*
3 November	*2016*	*Singapore*	*Singapore*

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This month's free brochure downloads

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Steer: Omega Star extruders

The Omega Series co-rotating twin screw extruders from Steer offer a Do/Di ratio of 1.71 and minimum specific torque of 11.3Nm/cm^3. This brochure provides key technical specifications for the eight models in the range.

➤ Click here to download

Plasmec: mixing technology

This 12-page brochure details the full range of mixing technologies available from Italy's Plasmec, including heating and heating/cooling combination models for PVC as well as units for powder coatings and WPC.

➤ Click here to download

Bay Plastics: Strand pelletizers

The SB series of strand pelletizers is designed to provide cost effective and robust performance with a wide range of polymer materials. This two-page brochure explains the key product features, throughput data and model specifications.

➤ Click here to download

MTI: PE-Xa mixing plant

Peroxide crosslilnked PE-Xa is a proven high performance material for gas, water and heating pipe applications. MTI's purpose-designed PE-Xa mixing technology can improve product quality, improve operator safety and reduce manufacturing cost.

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Xinda: compounding extruders

Learn more about the full range of reciprocating co-kneader and twin screw compounding extruders manufactured by Xinda Corporation in this 32-page brochure, which includes details on its latest SKW four-flight co-kneader product line.

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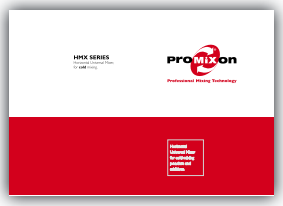
Promixon: HMX horizontal mixer



Developed for cold high intensity mixing of additives and powders, Promixon's HMX series of horizontal mixers can handle batch sizes from 100 to 5,000kg. This brochure explains the main design features and covers control and weighing options.

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If you would like your brochure to be included on this page, please contact Claire Bishop. claire@amimagazines.com. Tel: +44 (0) 1732 605976

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compounding WORLD Forum 2016

13-14 DEC 2016
PHILADELPHIA

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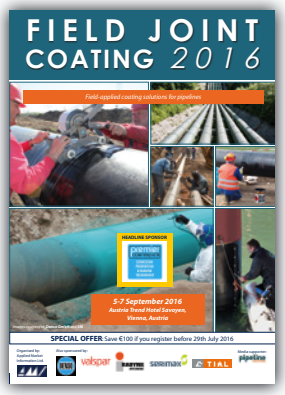
Field Joint Coating 2016



AMI's third Field Joint Coating conference takes place in Vienna, Austria, on 5-7 September and will again provide a learning and networking venue for all involved in materials, equipment and technologies for in-field application of protective coatings.

➤ **Click here to download**

Polyolefin Additives 2016

The ninth Polyolefin Additives conference takes place in Vienna, Austria, on 13-15 September 2016 and will, once again, provide a meeting point to learn more about global trends in polyolefin compound and additive development, application, selection and specification.

➤ **Click here to download**

Medical Tubing 2016

Running in Boston in the US on 13-14 September, Medical Tubing 2016 is a brand new conference focused on the very specific needs of the healthcare supply industry. This two-day event looks at innovation in polymer materials and extrusion technologies.

➤ **Click here to download**

Agricultural Film

AMI's 9th Agricultural Film conference takes place from 20-22 September in Barcelona, Spain, bringing together agricultural and horticultural cover specifiers, researchers, manufacturers, and film producers to discuss innovations in this demanding market sector.

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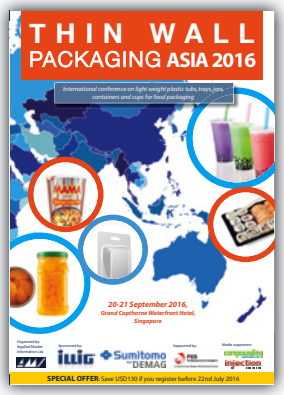
Thin Wall Packaging Asia



The first Thin Wall Packaging Asia conference will be held in Singapore on 20-21 September. This brand new event will build on the successful track record of AMI's European and US events and will bring together brand owners, retailers, specifiers and producers.

➤ **Click here to download**

Smart Packaging

Taking place in Cologne, Germany, on 20-21 September, Smart Packaging explores the latest innovations in active and intelligent packaging. The two-day programme features an international selection of brand owners, technology developers and converting experts.

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RECOMMENDED READING

Our selection of the latest titles and essential reference works for the compounding industry

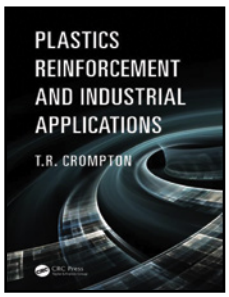
FLAME RETARDANTS FOR PLASTICS AND TEXTILES: PRACTICAL APPLICATIONS, 2ND EDITION

2015, by Weil & Levchik
€130.00 or £97.00 or $155.00

Flame retardants in commercial use organised by polymer type.

➤ More info/Buy here

PLASTICS REINFORCEMENT AND INDUSTRIAL APPLICATIONS

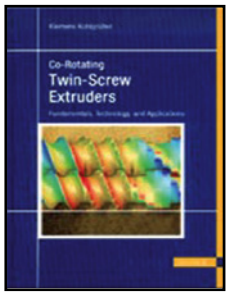


2015, by Crompton
€129.00 or £95.00 or $152.00

Discusses polymers, and reinforcing agents including natural materials and nanoparticles.

➤ More info/Buy here

CO-ROTATING TWIN-SCREW EXTRUDERS: FUNDAMENTALS, TECHNOLOGY, AND APPLICATIONS



2008, Klemens Kohlgrueber
€180.00 or £134.00 or $214.00

Provides essential engineering knowledge regarding twin-screw extruders, providing a foundation of knowledge about machinery, processes, and material behaviour.

➤ More info/Buy here

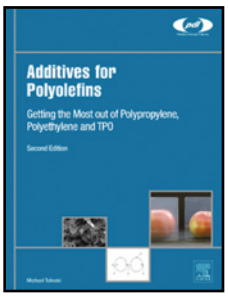
MIXING AND COMPOUNDING OF POLYMERS

2009, by Ica Manas-Zloczower
€300.00 or £223.00 or $356.00

This classic covers everything from the basic principles to the various practical applications of state-of-the-art mixing and compounding.

➤ More info/Buy here

ADDITIVES FOR POLYOLEFINS: GETTING THE MOST OUT OF POLYPROPYLENE, POLYETHYLENE AND TPO, 2ND EDITION



2015, by Tolinski
€169.00 or £125.00 or $200.00

Expanded and updated edition of the bestselling guide to enhanced properties and processing.

➤ More info/Buy here

INTRODUCTION TO POLYMER COMPOUNDING: RAW MATERIALS, VOLUME 1

2014, by Muralisrinivasan
€108.00 or £80.00 or $128.00

A concise introduction to polymers, additives, blends and composites.

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Please check the Plastics Information Direct website for current prices and shipping charges.

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Compounding World Asia

The second Compounding World Asia conference takes place in Singapore on 22-23 September 2016. This high level event brings together expert speakers to discuss compounding business strategies and explore the latest material and processing innovations.

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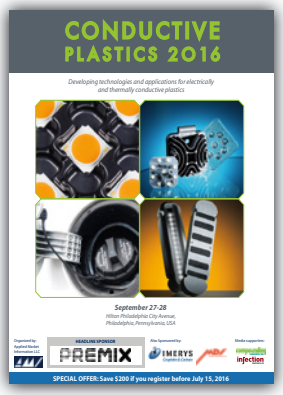
Conductive Plastics 2016



AMI's Conductive Plastics 2016 conference takes place on the 27-28 September in Philadelphia, USA. The event explores the latest additives, design concepts and processing ideas for development of thermally and/or electrically conductive plastics applications.

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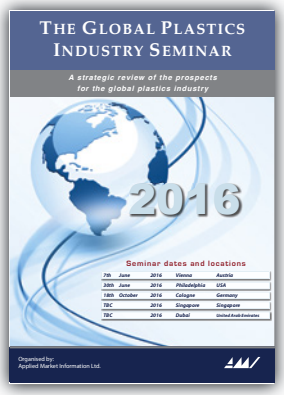
Global Plastics Industry Seminar



AMI's Global Plastics Industry Seminars have been providing up-to-the-minute industry analysis to polymer industry decision makers for more than a decade. The upcoming schedule includes Philadelphia, Dubai, Cologne and Singapore.

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Polymer Sourcing and Distribution

Taking place in Philadelphia, USA on 4-5 October 2016, Polymer Sourcing & Distribution 2016 will review polymer demand patterns and sourcing options and identify the key threats and opportunities for all players in the North American distribution sector.

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Waterproof Membranes 2016

AMI's 10th Waterproof Membranes conference takes place in Cologne in Germany on 7-9 November 2016. This high level international event brings together specifiers, engineers, researchers, and material and equipment suppliers to discuss the latest market and technology trends.

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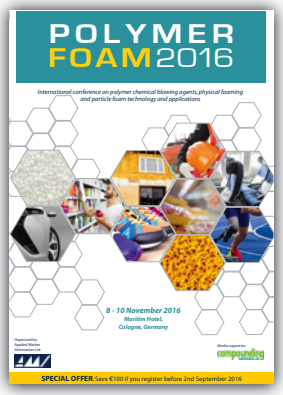
Polymer Foam 2016



AMI's fourth international conference on chemical blowing agents, physical foaming, particle foam processing and syntactic foam technology takes place in Cologne in Germany from 8-10 November 2016.

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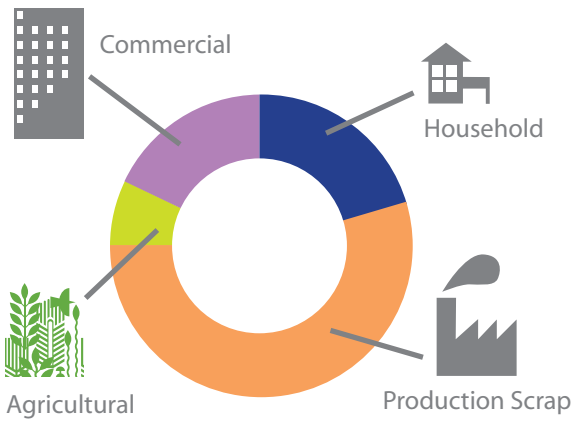
AMI's Directory

PLASTICS RECYCLERS IN EUROPE

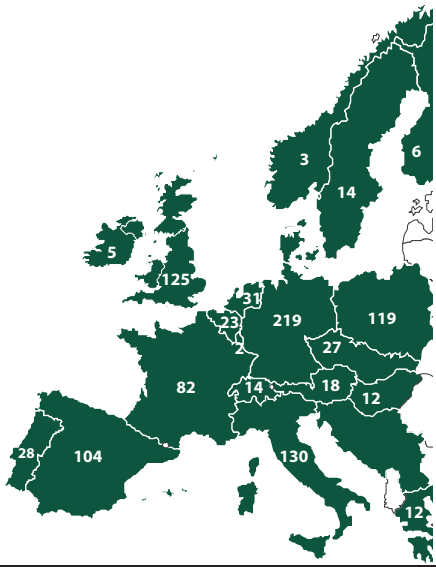
ESSENTIAL INFORMATION ON 993 PLASTICS RECYCLING SITES IN EUROPE

Key information leading you to all plastics recyclers in Europe

Source of Waste Recycled



Number of recyclers per country



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Multilayer Packaging Films 2016

The seventh North American Multilayer Packaging Films conference takes place in Chicago on 28-29 June and will examine the key commercial and technical issues facing specifiers, producers and users of coextruded and coated films.

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Pipeline Coating and Protection

Building on the success of AMI's European-based pipeline events, Pipeline Coating & Protection takes place in Houston, USA, on 15-16 November and will bring together experts from cross the pipeline sector to discuss technological and market developments.

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Plastics in Africa 2016

Dubai, UAE, hosts the second Plastics in Africa conference on 5 December 2016. The event will deliver expert insight into the key consumption trends and business developments in this fast growing marketplace for polymers.

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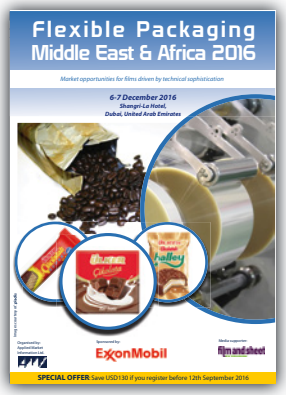
Flexible Packaging ME&A



Newly expanded to include Africa, AMI's Flexible Packaging MEA takes place from 6-7 December in Dubai providing the ideal opportunity to explore technical and commercial developments in these fast growing markets.

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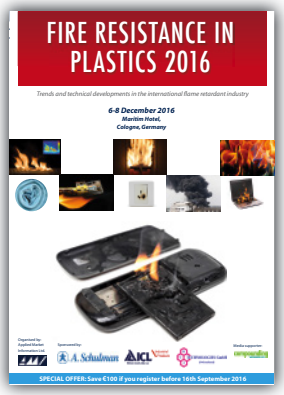
Fire Resistance in Plastics



The 11th Fire Resistance in Plastics conference takes place in Cologne in Germany on 6-8 December 2016. This international event explores the latest regulatory and technological developments in the flame retardants sector.

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Oil & Gas Non-Metallics 2016

AMI's second Oil & Gas Non-Metallics conference will be held in London on 12-14 December 2016. This international event examines the formulation, application and testing of polymers in demanding Oil & Gas applications such as composite pipes, seals, coatings and liners.

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Kkalpana Industries

Head office location:	Kolkata, India
Date founded:	1977
Chairman & MD	Mr Narrindra Suranna
Ownership:	Public company
Sales 2015:	US$260m (2015)
Plant locations:	Kolkata, Daman, Dadra, Falta and Surangi, India
Capacity 2015:	168,000 tonnes
Profile:	Founded in 1977 as Kalpena Industries, Kkalpana rapidly established itself as a strong player in the niche markets of PVC compounds and footwear. Since then it has diversified considerably. The company supplies the domestic Indian market from five production plants and exports compounds to more than 20 countries. It has installed capacity for PVC compounds of 36,000 tonnes, silane based PE compounds 65,800 tonnes, peroxide-based XLPE compounds 24,000 tonnes, PE & PP filled compounds 18,000 tonnes, semicon compound 12,500 tonnes, Halogen Free Flame Retardant (HFFR) compounds 8,000 tonnes, and ink and adhesives 4,200 tonnes.
Product line:	Aside from its cable industry PVC and PE compounds, Kkalpana also produces PVC, TPE and EVA compounds for footwear and pipe grade compounds, as well as white, black and performance enhancing additive masterbatches.
Product strengths:	The recently opened production unit at Surangi has enabled the company to offer XLPE, HFFR and filled PP for a more diversified range of industries, including the furniture and appliance markets.

To be considered for 'Compounder of the Month' contact Elizabeth Carroll at ec@amiplastics.com

compounding WORLD

Forthcoming features

The next issues of Compounding World magazine will have special reports on the following subjects:

September
Colour pigments
Materials testing & analysis
Antioxidants & UV stabilizers
K2016 show preview

October
Reinforcing fibres
Titanium dioxide
Active and intelligent packaging
K2016 show issue

Editorial submissions should be sent to Chris Smith: cs@amiplastics.com

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Compounding World – July
The July edition of Compounding World examines the latest developments in biocidal additives. It also reviews innovations in impact modifiers, discusses effective colour measurement, and looks at the latest melt filtration introductions.

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Compounding World – June
The June edition of Compounding World looks at the benefits and application of multiple-screw compounding systems. It also reviews the latest developments in additives for PVC, innovations in bioplastics, and new thinking for WPCs.

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Injection World – July/Aug
The July/August edition of Injection World magazine examines the latest developments in mould temperature control technology. This edition also looks at innovations in closure production and new introductions in the colour and additive masterbatch sector.

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Injection World – June
Under-the-hood automotive innovations feature in the June edition of Injection World magazine. We also review the Chinaplas 2016 trade show, update on new printing and decorating technologies, and look at equipment for plastic scrap recovery.

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Pipe and Profile – July/Aug
The July/August 2016 edition of Pipe and Profile Extrusion looks at the latest polymer applications in the Oil & Gas industry.This issue also explores new developments in extruder technology and additives for PVC formulation.

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Film and Sheet – Jul/Aug
The July/August edition of Film and Sheet Extrusion magazine looks at the latest converting machinery innovations. It also reviews developments in bioplastics and masterbatch and analyses the European collation film market.

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compounding WORLD injection WORLD pipe and profile EXTRUSION film and sheet EXTRUSION

Global exhibition guide

26-30 September	Colombiaplast, Bogota, Colombia	www.colombiaplast.com
19-26 October	K 2016, Dusseldorf, Germany	www.k-tradefair.com
6-9 November	Pack Expo, Chicago, USA	www.packexpointernational.com
14-17 November	Emballage, Paris, France	www.all4pack.com
2017		
8-10 January	Arabplast, Dubai	www.arabplast.info
19-23 January	Plastivision India, Mumbai, India	www.plastivision.org
24-26 January	Swiss Plastics, Lucerne, Switzerland	www.swissplastics-expo.ch
24-27 January	Interplastica, Moscow, Russia	www.interplastica.de
8-10 March	JEC World, Paris, France	www.jeccomposites.com
20-24 March	Plástico Brasil, São Paulo, Brazil	www.informagroup.com.br
4-6 April	EU Coatings Show, Nuremberg, Germany	www.european-coatings-show.com
3-5 May	JEC Americas, Atlanta, GA, USA	www.jeccomposites.com
4-10 May	Interpack, Dusseldorf, Germany	www.interpack.com
16-19 May	Chinaplas, Guangzhou, China	www.chinaplasonline.com
17-21 May	Feiplastic, Sao Paulo, Brazil	www.feiplastic.com.br
30 May- 2 June	Moulding Expo, Stuttgart, Germany	www.moulding-expo.com
8-10 June	Kenya Plast, Nairobi, Kenya	www.kenyaplast.in
13-16 June	FIP, Lyon, France	www.f-i-p.com
7-10 July	Interplas Thailand, Bangkok	www.interplasthailand.com

AMI conferences

13-15 Sept	Polyolefin Additives, Vienna, Austria
20-21 Sept	Smart Packaging, Cologne, Germany
22-23 Sept	Compounding World Asia, Singapore
27-28 Sept	Conductive Plastics, Philadelphia, PA, USA
4-5 Oct	Polymer Sourcing & Distribution, Philadelphia, PA, USA
8-10 Nov	Polymer Foam, Cologne, Germany
6-8 December	Fire Resistance in Plastics 2016, Cologne, Germany

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

www.amiplastics.com

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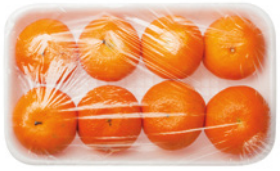
PolyolefinAdditives2016

International conference on polyolefin performance, compounding, blending and additives

13-15 September 2016

Imperial Riding School Renaissance Hotel, Vienna, Austria

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PolyolefinAdditives2016

13-15 September 2016,
Imperial Riding School Renaissance Hotel, Vienna, Austria

AMI's next international conference on Polyolefin Additives will take place from 13th to 15th September 2016 at the Imperial Riding School Renaissance Hotel in Vienna, Austria. The event begins with a welcome evening reception for all delegates on 13th September, followed by a busy two-day technical programme.

Polyolefins lead the global plastics markets in terms of production volumes and the diversity of their applications. For example, polyethylene pipes are gaining share in construction, agricultural films are transforming crop yields in arid regions, polyolefin packaging is preserving foodstuffs and minimising waste, while the use of polypropylene as a metal replacement is reducing weight in automotive manufacturing.

The different properties of polyethylene and polypropylene materials are obtained by careful selection of resin, additives and processing methods. AMI's Polyolefin Additives 2016 brings together industry experts to debate the optimal resins, additives and compounds for a wide range of end uses from packaging films to automotive components.

In addition to the information-packed conference sessions, the event will provide plenty of networking opportunities during the evening cocktail reception, the refreshments breaks, the lunches and the evening dinner.

Polyolefin Additives 2016 will be relevant for the complete polyethylene supply chain including resin producers, additives suppliers, compounders, plastics processors, product designers, and materials specifiers at OEMs and end-users. It provides a chance to check up on the latest developments and to catch up with your industry contacts in one trip out of the office. Do join us in Vienna this September!

FIVE GOOD REASONS WHY YOU SHOULD ATTEND:

1. **Learn about the very latest developments in polyolefin additives**
2. **Network with key players from throughout the polyolefin supply chain**
3. **Hear about key market trends and new application opportunities**
4. **Explore how to optimise polyolefin formulations for high-end performance**
5. **Discover the results of recent research work into additive technologies**

CONFERENCE HOTLINE

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Fax: +44 (0) 117 311 1534
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POLYOLEFIN ADDITIVES 2016: EXHIBITION SPACE

Make it easy for the delegates to find you at this busy event with your own table top exhibition space. Bring your own display stand, banners or use the space to showcase samples of your products and ensure that you make an impact. The table top exhibition will run throughout the conference in the spacious lobby next to the main meeting room.

Registration includes 1 delegate place!

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

SPONSOR THIS EVENT

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

HOTEL ACCOMMODATION

Delegates are responsible for booking their own accommodation. AMI has negotiated a limited number of rooms at the rate of €143.37 for a single room and €158.41 for a double (breakfast, Wi-Fi and taxes included) at the Imperial Riding School Renaissance Hotel in Vienna for a limited time only. Please make your reservation using the direct hyperlink which can be found on the Accommodation tab of the Polyolefin Additives 2016 webpage. Please visit www.amiplastics.com.

CONFERENCE VENUE

Vienna is renowned for its café culture with palaces from the Habsburgs' Empire to museums and classical music. It has a lighter side with a central park and an extensive range of restaurants, shopping and entertainment. In the winter there is ice skating, tobogganing and skiing in Vienna and the environs of the city. www.wien.info is the official tourism website of this beautiful city.

*+20% Austrian VAT

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POLYOLEFIN ADDITIVES 2016

Tuesday 13th September 2016

18.00-19.30 Registration and Welcome Cocktail Reception
There are no conference sessions on this day

Wednesday 14th September 2016

08.00 Registration and welcome coffee
09.00 Opening announcements

SESSION 1 - EXPLORING MARKET TRENDS AND APPLICATION OPPORTUNITIES

09.10 **Opportunities in the market for polyolefin additives**
Mr. Noru Tsalic, Senior Vice President,
AMI CONSULTING, United Kingdom

09.40 **Novel technology for additive blends – one-packs and their applications**
Dr. Kasinath Nayak, Sr. Technical Service Manager, Antioxidants,
SI GROUP, United States

10.10 **Polyolefin hygiene films: regulatory, technical and supply chain perspective**
Dr. Fatih Mehmet Ergüney, R&D Manager,
HAYAT KIMYA, Turkey

10.40-11.20 Morning coffee sponsored by: SI Group The Substance Inside

SESSION 2 - MEETING PACKAGING PERFORMANCE REQUIREMENTS

11.20 **Polyolefin additives – practical aspects for flexible packaging converters**
Dr. Birgit Faust, Senior Analytical Manager Food Contact Materials,
DOW OLEFINVERBUND GmbH, Germany

11.50 **Meeting the performance requirements for polypropylene and polyethylene sheet in food packaging applications**
Mr. Kurt Kuruç, General Manager,
FARMAMAK, Turkey

12.20 **Specific migration of chemicals in food contact materials**
Mr. Svein H. Jamtvedt, Principal Researcher,
NORNER A.S., Norway

12.50-14.20 Lunch

SESSION 3 - INNOVATIONS IN POLYOLEFIN ADDITIVES

14.20 **Polyolefin polymer based high-performance modifiers for recycling, adhesion and antistatic applications**
Dr. Karlheinz Hausmann, R&D Fellow,
DUPONT DE NEMOURS INTL SARL, Switzerland

14.50 **Reactive antioxidants for crosslinked polyethylene**
Prof. Sahar Al-Malaika, 50th Anniversary Professor of Polymer Science,
ASTON UNIVERSITY, United Kingdom

15.20 **Polyolefin-polar block copolymers: bridging the gaps in polyolefins**
Dr. Christopher Kay, Chief Scientific Officer,
INTERFACE POLYMERS Ltd., United Kingdom

15.50-16.30 Afternoon tea

SESSION 4 - TAILORING THE PROPERTIES OF POLYOLEFINS

16.30 **Talc filled recycled polyolefin: mechanical and crystallisation behaviour**
Dr. Bhawna Kulshreshtha, Sr Scientist,
BOREALIS POLYOLEFINS GmbH, Austria

17.00 **A novel permanent antistatic agent for industrial packaging**
Mr. Kazukiyo Nomura, Team Leader of Polymer Additives Research Department,
ADEKA CORPORATION, Japan

17.30 **Recent advances in polyolefin additives for improved stabilization, gel reduction, flame retardancy and UV resistance**
Dr. Hartmut Siebert, Business Development Manager,
CLARIANT INTERNATIONAL Ltd., Switzerland

20.00 Conference Dinner

Thursday 15th September 2016

08.30 Registration and welcome coffee
09.00 Opening announcements

SESSION 5 - STRATEGIES FOR SUCCESSFUL STABILIZATION

09.10 **Latest developments for stabilization systems in automotive applications**
Mr. Gregor Huber, Global Competence Centers – Head Automotive,
BASF, Switzerland

09.40 **Meeting the challenges of high-end stabilization of polyethylene**
Mr. Thomas Schmutz, Director Technical Service & Application Development,
SONGWON INTERNATIONAL AG, Switzerland

10.10 **Stabilization of reinforced polypropylene for demanding automotive environments**
Mr. Jim Dutchik, Business Development Manager,
ASAHI KASEI PLASTICS EUROPE, Germany

10.40-11.20 Morning coffee sponsored by: NJC EUROPE

SESSION 6 - FLEXIBLE SOLUTIONS – ENHANCING FILM PROPERTIES

11.20 **Enhancing the performance of PP film resins with multi-modal PP technology and proper choice of additives**
Ing. Johannes Wolfschwenger, Product Management – Raw Materials Owner,
BOREALIS POLYOLEFINE GmbH, Austria

11.50 **Innovative LLDPE product with high clarity and low blocking**
Dr. Poondi Srinivasan, Senior Product Development Resource,
EQUATE PETROCHEMICAL COMPANY, Kuwait

12.20 **Sustainable plant-based antistatic agents with long lasting performance**
Ms. Christina Normann Christensen, Msc. in Chemical Engineering,
PALSGAARD A/S, Denmark

12.50-14.20 Lunch

SESSION 7 - BURNING ISSUES - NEW DEVELOPMENTS IN FLAME RETARDANTS

14.20 **Sustainable approaches for the flame retardancy of reinforced polyolefins**
Ms. Sophie Duquesne, Associate Professor,
ENSCL-UMET, France

14.50 **Transparent flame retardant masterbatch for film and sheet**
Mr. Andreas Kaya, Managing Director,
FELS KUNSTSTOFFTECHNIK GmbH., Germany

15.20 **Recent developments in flame retardants for polyolefins**
Dr. Rudolf Pfaendner, Division Director Plastics,
FRAUNHOFER INSTITUTE FOR STRUCTURAL DURABILITY AND SYSTEM RELIABILITY LBF, Germany

15.50 Afternoon tea and conference ends

Conference bag sponsored by: SUMITOMO CHEMICAL

Conference lanyard sponsored by: SONGWON

AMI reserves the right to alter the programme without notice.
The latest programme can be viewed on our website ***www.amiconferences.com***

Click here for a PDF of the brochure

REGISTRATION FORM

Company: _____

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(Must be completed by all EU Companies)

Company activity: _____

Purchase order No. *(if applicable)*: _____

Invoice address *(if different from above)*: _____

_____

_____

DELEGATE DETAILS

If more than one delegate please photocopy form

Title: _____ First name: _____

Surname: _____

Position: _____

Email: _____

Special dietary requirements: _____

Signature: _____ Date: _____

PAYMENT DETAILS

All payments to be made in Euros

Please tick box and write amount:

❑ Early bird admission fee: *(Until 22nd July 2016)*	€1090 + €218* = €1308	_____
❑ Admission fee thereafter:	€1190 + €238* = €1428	_____
❑ Table top exhibition package: *(Includes 1 delegate place)*	€2000 + €218**= €2218	_____
❑ Conference Dinner:	€90	_____

(**Only admission fee part of package is VAT chargeable at 20%)

Austrian VAT charged at 20%* **Total: _____

Please note all delegates have to pay the VAT stated above.

METHOD OF PAYMENT

On receipt of this registration form your credit card will be debited. You will be sent an invoice in 7-14 working days.

❑ **Bank transfer quoting:** 'Applied Market Information Ltd.- Polyolefin Additives 2016' to: Commerzbank, Filiale Düsseldorf, Breite Straße 25, 40213 Düsseldorf, Germany
Account number: **1024710** Bank No. **300 400 00**
IBAN: **DE93 3004 0000 0102 4710 00** SWIFT: **COBADEFFXXX**

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If paying by card the following information **must** be given

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POLYOLEFIN ADDITIVES 2016
CONFERENCE INFORMATION

Date and location
13-15 September 2016
Imperial Riding School Renaissance Hotel
Ungargasse 60
1030 Vienna
Austria

Tel: +43 1 711 750
Fax: +43 1 711 75 8146

Registration fee
The registration fee includes attendance at all conference sessions, the Welcome Cocktail Reception, lunch and refreshment breaks on both days and a set of conference proceedings.

- ***Early bird registration:*** Register before 22nd July 2016 for only €1090*. Thereafter the cost is €1190*.
- ***Group rates:*** For companies wishing to register two or more delegates, group discounts are available. Please contact the Conference Organiser for more details. (Please note to qualify for the group discount delegates must be booked at the same time, otherwise additional delegates may be charged at full price).

Polyolefin Additives 2016 table top exhibition
A limited number of table top exhibition spaces are available in the spacious lobby next to the main meeting room. The table top exhibition fee is excellent value for money and **includes 1 delegate place**. Exhibitors may either use tables provided by the hotel or bring their own stand or display.

Sponsor this event and promote your company
A variety of sponsorship opportunities are available at this event that can help to promote and enhance your company's products and services to this highly targeted international audience. For further information, please contact the Conference Organiser on: +44 (0) 117 314 8111.

Social events
The social events organised for Polyolefin Additives 2016 will provide an ideal setting for delegates and speakers to mix business with pleasure.

- ***Welcome Cocktail Reception:*** A welcoming cocktail reception will be held on the first evening. All delegates are invited to attend and it will offer an excellent opportunity to meet speakers and other colleagues. The Welcome Cocktail Reception will run approximately from 18.00 to 19.30 and is included in the delegate fee.
- ***Conference Dinner:*** All delegates are warmly invited to attend the Conference Dinner, which will take place at a local restaurant on the evening of 14th September 2016. The additional cost is €90.

Hotel accommodation
Delegates are responsible for booking their own accommodation. AMI has negotiated a limited number of rooms at the rate of €143.37 for a single room and €158.41 for a double (breakfast, Wi-Fi and taxes included) at the Imperial Riding School Renaissance Hotel in Vienna for a limited time only. Please make your reservation using the direct hyperlink which can be found on the Accommodation tab of the Polyolefin Additives 2016 webpage. Please visit www.amiplastics.com.

Cancellations
Full refunds, less a cancellation charge of €200 will only be made on cancellations received prior to 12th August 2016. Thereafter we regret that no refunds can be made. Delegates may be substituted at any time. Please note that refunds will not be given on table top bookings, sponsorship packages or Conference Dinner places.

*+20% Austrian VAT

CONFERENCE HOTLINE

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The latest programme, including any new speakers or changes to the schedule can be viewed on our website: **www.amiconferences.com**

Fax back to: +44 (0) 117 311 1534 or Email: nc@amiplastics.com