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Injection WORLD

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IMAGE: CELANESE



Above: The acquisition adds new engineering materials and production to Celanese's position in automotive and other markets

Celanese buys DuPont engineering plastics

Celanese has reached an agreement to acquire a majority of DuPont's Mobility & Materials (M&M) business, including the Engineering Polymers business line and some of the Performance Resins and Advanced Solutions business lines, for \$11.0bn.

This, said Celanese CEO Lori Ryerkerk, follows a decade of extending its own Engineered Materials (EM) business and "establishes Celanese as the pre-eminent global specialty materials company". DuPont has also agreed to retain and indemnify Celanese for certain liabilities, including those relating to PFAS.

Being acquired are a

wide portfolio of speciality materials including PA 66 and PA 6, speciality PAs such as HPPA, LCPA and filaments, PET, PBT, TPC and EAE. Celanese also gains a global production network of 29 facilities, including compounding and polymerisation, employing about 5,000, an IP portfolio of some 850 patents, and customers and supplier contracts.

These materials go mainly into automotive, electrical and electronic, consumer goods and industrial applications. Tom Kelly, Senior VP of Engineered Materials said that Celanese will seek to "combine the product and

technology leadership of M&M with the commercial excellence and customer engagement model of EM to accelerate our growth in high-value applications including future mobility, connectivity and medical".

DuPont also aims to divest the Delrin acetal homopolymer business, which was included in the strategic review process it announced in November 2021, by the first quarter of 2023. This had net sales of about \$550m in 2021. DuPont is retaining M&M's Auto Adhesives, Multibase and Tedlar product lines, which had \$950m in sales in 2021.

> www.celanese.com

> www.dupont.com

Ensinger acquires StyLight

Ensinger of Nufringen, Germany, has acquired Ineos Styrolution's StyLight thermoplastic composite materials business, which was originally launched at the K show in 2016.

The business has already been rebranded under Ensinger's Tecatec composites range name.

Ensinger said that the acquisition adds a SAN-based product range to its portfolio, bringing many new possibilities to the market. These include carbon-, glass- and flax-based fibre products for aesthetic materials, and for semi-structural and overmoulding applications.

Managing Director Ralph Pernissak said that this is "the next strategic building block in Ensinger's journey to becoming one of the only manufacturers able to offer the complete value chain of thermoplastic composite products".

> www.ensingerplastics.com

Molded Dimensions buys GlobalTech Plastics

US-based Molded Dimensions, a manufacturer of custom rubber and urethane moulded parts to OEMs, has acquired GlobalTech Plastics of Fife, Washington, USA. Terms were not disclosed and no jobs will be lost.

GlobalTech is an injection moulder

specialising in the aerospace, medical and transportation industries.

The acquisition, said Molded Dimensions, will help it to broaden its manufacturing capabilities to include plastic moulded parts and components and establish a location on the US

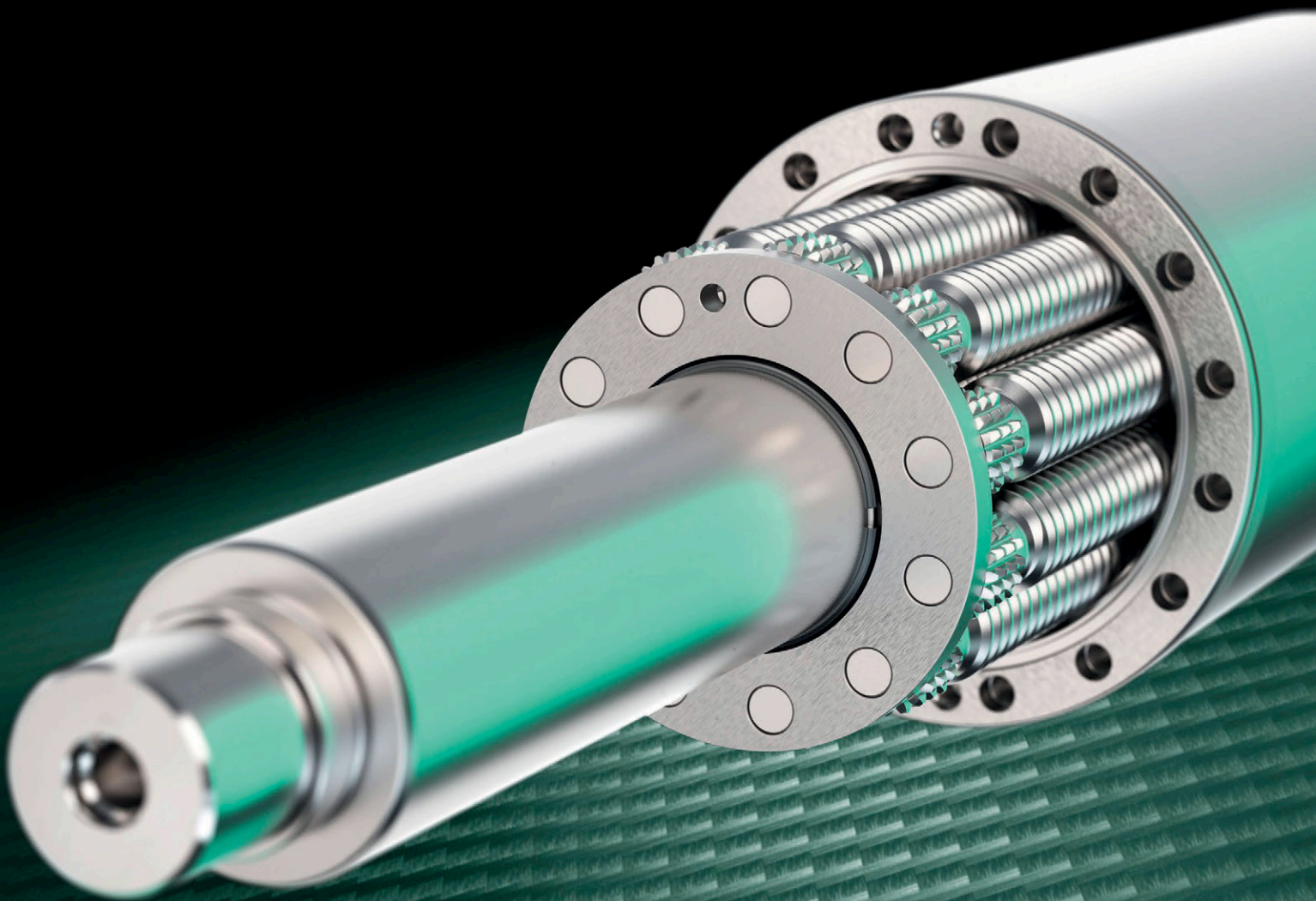
West Coast.

The acquisition follows on from Molded Dimensions buying high-volume PUR parts maker PCO Urethane in December 2021.

> www.molddimensions.com

> www.globaltechplastics.com

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KM brings together LSR partners

The Würzburg-based Plastics Centre (SKZ), Toolcraft, of Georgensgmünd near Nürnberg, and their German compatriot, the injection moulding machinery giant KraussMaffei, have all come together to work on the processing of liquid silicone rubber (LSR).

SKZ, which has been hitherto mainly known for thermoplastic processing, recently appointed KraussMaffei as its technology partner for LSR. As Toolcraft also wanted to start working with the technology at the same time, KraussMaffei brought all three together.

SKZ and Toolcraft will build up the expertise necessary for manufactur-



IMAGE: SKZ

Above: SKZ has its headquarters in Würzburg, Germany

ing, expert advice and vocational training. KraussMaffei is providing the all-electric machines (a PX 50 at SKZ and a PX 121 at Toolcraft), plus expertise and consulting related to processing. They anticipate being able to apply for public subsidies to help them develop technologies.

In the coming months,

SKZ and Toolcraft will work on a new mould for LSR to address the challenges arising from low viscosity and temperature control. The first product has already been defined: a medical application with a part weight of 0.5 g.

KraussMaffei said: "For many years, processing LSR was limited to specialist

companies. Despite the material's strong growth, it had been viewed as being difficult to work with. This is currently changing, as more and more plastics processing companies are becoming interested in this versatile material."

➤ www.kraussmaffei.com

➤ www.skz.de

➤ www.toolcraft.de

New US training partnership

LS Mtron Injection Molding Machines USA has formed a partnership with Orbital Plastics Consulting to provide scientific injection moulding training. LS Mtron produces injection moulding machines in South Korea.

Courses being offered include both injection moulding training at LS Mtron's technical centre in Wood Dale, near Chicago, and onsite injection moulding training at LS Mtron customer locations.

The courses will be taught by Orbital president Umberto Catignani.

➤ www.lsinjection.com

Comar buys medical moulder Automatic Plastics in Ireland

New Jersey, US-based Comar, a supplier of custom medical devices and assemblies and speciality packaging systems, has acquired Automatic Plastics (APL), a contract manufacturer of injection moulded

products mainly for medical devices and rigid pharmaceutical packaging.

APL operates out of an ISO 13485-certified production facility in Wicklow, south of Dublin, Ireland. This has 30 injection moulding

machines ranging from 25 to 485 tonnes. The company has particular expertise in design and development, overmoulding, two-shot moulding, automation, handling and packaging of desiccants, and custom printing.

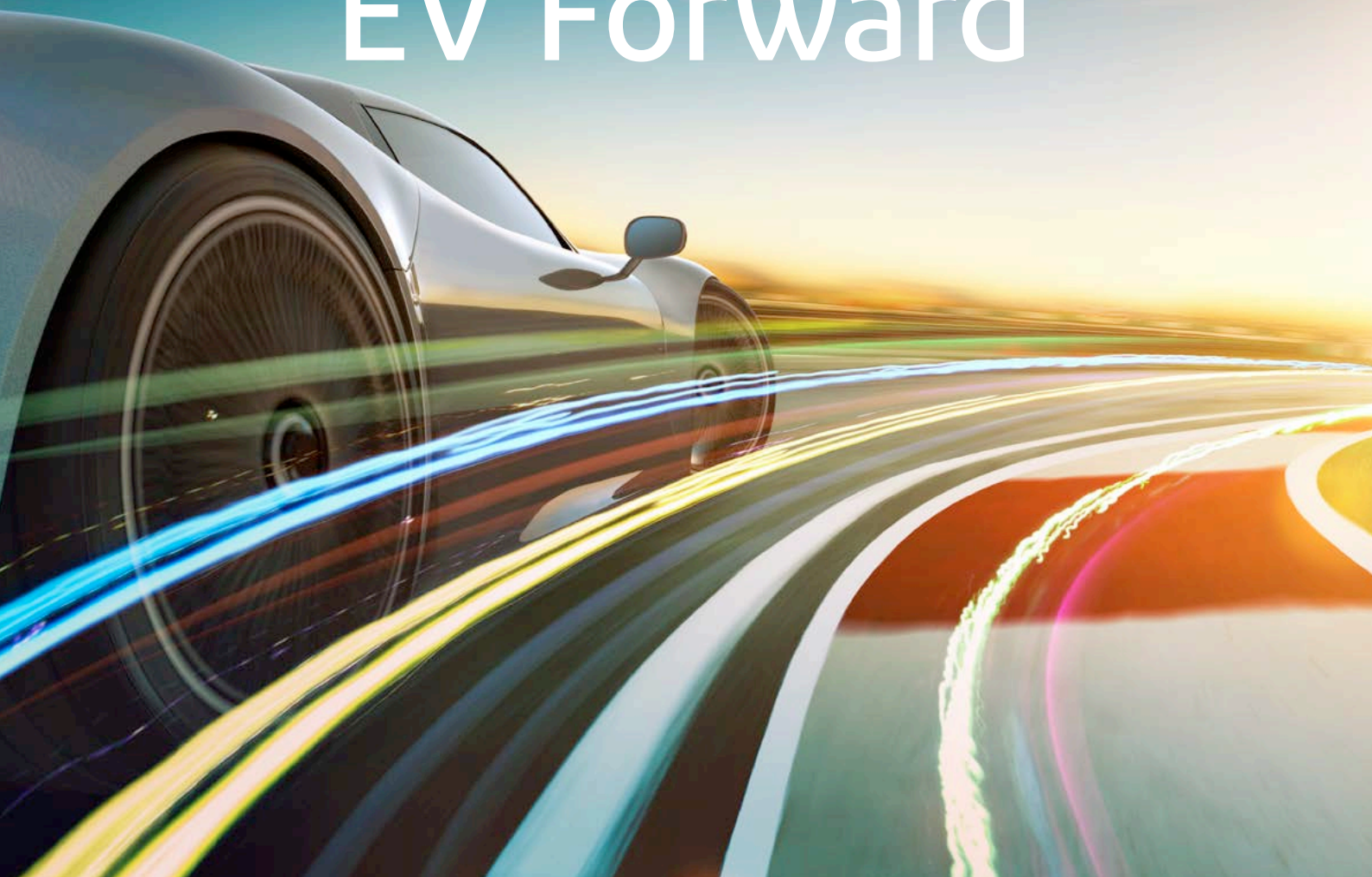
Comar said that this combination will enhance its own expertise in the same fields and represents the first step in its global expansion, not least because Ireland is one of the world's major medtech and pharmaceutical industry hubs. Comar will now have 11 manufacturing facilities and over 1,200 employees worldwide.

➤ www.comar.com



IMAGE: APL

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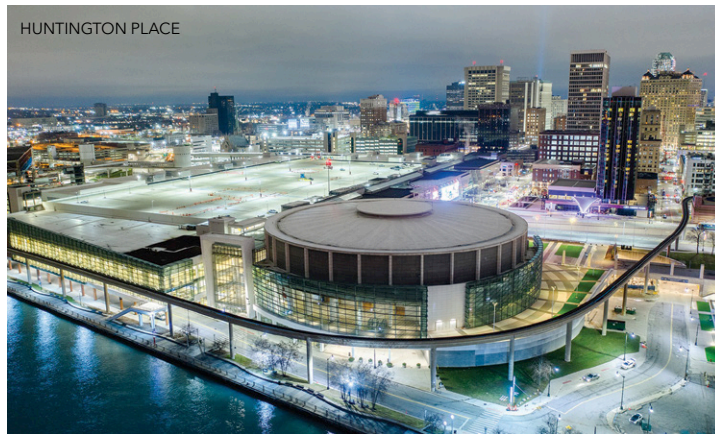
100+ suppliers book booths at Detroit moulding expo

More than 100 suppliers have already booked booths at the Injection Molding and Design Expo, which is taking place in Detroit, Michigan, USA on May 25-26, 2022. The new free-to-attend exhibition and conference is being organised by AMI – the publisher of *Injection World* – together with Crain Global Polymer Group – the publisher of *Plastics News*.

"We have seen a rapid increase in exhibitor bookings in the past two months and the floorplan is filling up quickly," said Kelly DeFino, Exhibition Sales Manager at AMI. "More than two thirds of booths are now taken, and inquiries plus new reservations are coming in every day."

The event is taking place at Huntington Place (formerly known as the Cobo and TCF Center) in downtown Detroit. Visitors will be able to meet with a wide range of international suppliers from throughout the injection moulding supply chain at one focused event. It will provide a timely opportunity to catch up on recent developments and compare options for future projects.

Leading suppliers of injection moulding machines that will be exhibiting in Detroit this May include Milacron, KraussMaffei, Wittmann Battenfeld, Absolute Haitian, Tederic, Shibaura, Yizumi-HPM, Wilmington Machinery and CH America.



They will be joined by a wide range of suppliers of auxiliary equipment, machine components and control systems, including Conair, ACS Group, Advanced Blending Solutions, Frigel, Matsui, Zeiger Industries, ASS End Of Arm Tooling, Frigosystem, Kongskilde, Bauer Compressors, Benpac, Cincinnati Process Technologies, Intouch Monitoring, 2R Automation, Alpha Laser, Alkegen, Promess, Zerma and Filtril.

Mould makers and suppliers of mould materials, components and accessories also feature prominently among the companies that have already confirmed their spaces at the show. They include Cavalier Tool, StackTeck, Accede, DME, Mastip, Progressive Components, Spark Industries, PCS, EAS Change Systems, VEM Tooling, Osco, Mold World, and Action Mold & Machining. There will also be a group of Portuguese mould makers exhibiting along with their trade association Cefamol. In addition, tooling design software and services will be on offer from a variety of

exhibitors including Sigmasoft, Moldex3D, EPS FloTek, CAE Services, TST and Simcon.

On the materials front, companies that have already booked booths include M Holland, Ampacet, Chroma Color, Chase Plastics, Domo, General Polymers, Amco Polymers, Star Plastics, Polykemi, Opticolor, Purgex, Polymax,

Entec, Bamberger Polymers, Purgex, Slide Products, Rainbow Colors, Saco AEI Polymers, and iD Additives.

Several leading suppliers of training services for moulders will also be exhibiting at Detroit, including Beaumont, RJG, Routsis and Paulson. Visitors to the expo will be able to attend practical seminars delivered by these companies in the free Training Theater.

"The industry response to this new expo has been overwhelmingly positive," said John Hickey, Sales Director at Plastics News. "Suppliers have welcomed the focus of the event, plus its location and timing. They are also excited about the fact there will be three free-to-attend conference theatres on the show floor, with programs put together by the Crain and AMI teams."

For more information about exhibiting at the Injection Molding and Design Expo 2022, or to register for your free ticket, please visit:

➤ www.injectionmoldingexpo.com

Record revenue for Protolabs in 2021

US fast parts manufacturer Protolabs had record annual revenue of \$488.1m in 2021, 12.4% up on 2020. Net income was \$33.4m and

the company said that it served 55,330 unique product developers during the year.

"2021 was a transforma-

tive year for Protolabs. With the acquisition of Hubs and the launch of Protolabs 2.0, we are well positioned to execute on our long-term

strategy to accelerate revenue growth and expand profitability," said CEO Rob Bodor.

➤ www.protolabs.com

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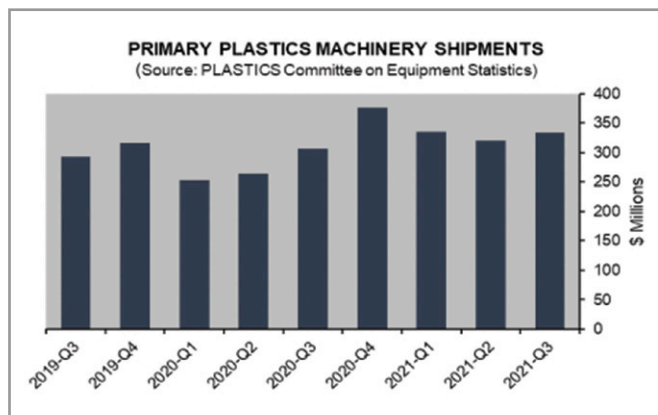
US machine shipments up in Q3

Shipments of primary plastics processing machinery in North America were up by near 9% year-on-year in Q3 2021, according to data from the Committee on Equipment Statistics (CES) at the US Plastics Industry Association.

Preliminary CES estimates put shipments at \$334m for the quarter, up by 4.0% on Q2 and 8.8% on Q3 2020.

Shipments of twin-screw extruders saw the biggest gains – up by 44.4% and 61.2% respectively. Single-screw extruders saw growth of 7.2% and 15.9%, while injection moulding machinery shipments grew by 1.6% and 5.7%.

The performance was in line with higher plastics production and the continued recovery in the US



economy, said Plastics Industry Association Chief Economist Dr Perc Pineda.

According to CES, 76% of machinery executive respondents to its latest quarterly sentiment survey expected market conditions to either improve or hold steady in Q4, while 75% expected a similar outlook for the following 12 months.

"Data we're seeing

confirm our prior projections that the outlook for plastics machinery in the second half of 2021 is positive albeit shipments [would] continue to fluctuate. The likelihood that supply chain issues will continue to be a headwind in 2022 remains high. The globe is still emerging from the pandemic," said Pineda.

➤ <http://plasticsindustry.org>

Italian machinery picks up

Italy's plastics and rubber machinery manufacturers saw a 14% increase in sales for the first nine months of last year, fuelled largely by healthy domestic demand, according to industry association Amaplast. Incoming orders rose by 41% over the period.

Amaplast said sales grew 17% in Q3 compared to the same period in 2020, and orders were up by 30%. Expectations for Q4 are positive, with revenues expected to come in some 60% up on Q4 2020.

➤ www.amaplast.org

Barnes reports 2021 sales

US-based diversified engineering company Barnes Group has reported net sales of \$1.259bn in 2021, up 12% from \$1.124bn in 2020. Of this, all but 1% was organic growth.

Sales in its Industrial division were up 16% to \$896m – the division includes mouldmaking and moulding technology brands Synventive, Foboha, Thermoplay, Maenner, Gammaflux and Priamus.

➤ www.barnesgroupinc.com

Executive changes at Engel in Austria and North America

The Engel Group has named Gerhard Dimmler, previously VP of R&D, in the role of CTO which gives him a place on the board. As part of this role, he is taking over the Development division from CEO Stefan Engleder and will also be responsible for digitalisation generally.

In addition, Simon Zeilberger will arrive as Commercial Director on 1 April. He is replacing CFO Markus Richter, who will leave the company after five years at his own request at the end of the fiscal year. Zeilberger has extensive



IMAGE: ENGEL

Above: Gerhard Dimmler, the new CTO at Engel Group

management experience, mainly in the metals industry, and was most recently responsible for the commercial division of a

large family foundation.

Separately, Engel has created a new management board in its North America business. This comprises COO Vanessa Malena (leading after-sales service, automation and engineering); CSO Benjamin Lettner (sales, marketing and application engineering); and CFO Johann Dastl (finance, HR and IT). Mark Sankovitch remains as CEO. Paul Caprio left Engel North America as of 31 January, after two years with the company.

➤ www.engelglobal.at

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Recycled plastics are starting to be used in furniture, but designers face technical challenges and need to work out how to deal with them. David Eldridge explores the world of plastic chair design

Chair designers learn all about recycled plastics

The humble chair fascinates designers. At some point in their career, furniture designers, product designers and even architects want to create their personal variation on the seat-plus-legs template. With its simple form and functionality, a chair presents the challenge of how to design something different, desirable and destined for classic status.

In the 1950s, chair designers seized the opportunity given by a new, highly adaptable material to create chairs with a more moulded shape than was possible with wood and other materials. Plastics enabled Charles and Ray Eames in 1950 to make the DAR armchair with a fibreglass shell seat and metal supporting framework. Then plastics materials became a major focus in new chairs from designers: Robin Day even called his 1963 combination of plastic seat and metal legs the Polyprop chair. The PP seat in Day's chair was injection moulded, enabling mass production and widespread utilisation in British schools.

Furniture designers have come to know a lot about plastics, their properties and their potential for achieving an aesthetic vision. They have often worked closely with materials companies and manufacturers in the development of a new chair. A good example is Konstantin Grcic who collaborated with **BASF** on the MYTO cantilever chair, injection moulded in Ultradur High Speed.

"The design was significantly influenced by the material," says Grcic. "Chemically speaking, this



material belongs to the family of polybutylene terephthalate (PBT). Its high flowability, coupled with the strength of this plastic, allows an elegant transition from thick to thin cross sections."

MYTO was presented for the first time on BASF's stand at K 2007. It rapidly became a classic, and in May 2008 was selected into the permanent collection of the Museum of Modern Art in New York.

But since plastics have been caught in the glare of negative publicity about ocean waste, designers have turned their attention to the sustainability of the materials they use. From this, furniture companies and their designers have decided to relaunch some plastics chairs to include recycled material. Outdoor furniture company Loll Designs has updated the wooden Rapid Rocker designed in 1939 by architect Ralph Rapson to use HDPE recycled from milk bottles. Norway-based Flokk has issued a limited edition of the HÅG Capisco Puls office chair, designed in 1984 by Peter Opsvik, using PP recycled from snow plough markers. Some designers are also specifying recycled plastics when developing new chairs, such as the N02 Recycle, designed by Oki Sato of Nendo for Danish furniture company Fritz Hansen, which uses post-consumer plastics.

The trend to include recycled content in injection moulded chair components was shown last year in



IMAGE: JASPER MORRISON STUDIO / VITRA

Main images: Vitra's Evo-C chairs, designed by Jasper Morrison, are manufactured using gas injection moulding technology

Right: The plastic parts in the Kirn chair from furniture company OrangeBox are made from Domo's Econamid recycled PA materials

the contribution of polyamide producer **Domo Chemicals** to the Kirn chair from Wales-based office furniture company **OrangeBox**. Domo's Econamid PA materials, which are used in the plastic parts of the chair, are produced from post-industrial recycled textile fibres. The Kirn chair was developed by Orangebox with support from Linear Plastics, an injection moulder regularly used by Orangebox, and Domo's European distributor, Ultrapolymers.

Orangebox says that the use of the Econamid material means Kirn's manufacture produces 97% fewer CO₂ emissions than that of a task chair made from virgin plastic. In addition, the chair is designed to use as few materials and resources as possible, and uses recycled materials wherever feasible.

In the world of office furniture, **Herman Miller** is a company with a long and respected design pedigree. In September last year, it said it has started using recycled plastics in its Aeron chair range, as part of the company's commitment to use 50% recycled content in all materials by 2030. Aeron, Herman Miller's top selling chair, was designed by Bill Stumpf and Don Chadwick in 1994 (with a new version in 2016). Its highly engineered design, ergonomic excellence and material innovation (eradicating the foam and leather found in most office chairs at the time) led to many awards and many imitators. It was also the company's first product to receive the Cradle to Cradle V3 Silver Level certification, assessed on environmental and social performance.

Herman Miller is being supplied with recycled material through its involvement with NextWave Plastics, a collaboration of technology companies and consumer brands to develop a global network of ocean-bound plastics supply chains. The ocean-bound plastics used in Aeron is currently sourced from India and Indonesia.

Gabe Wing, Herman Miller's Director of Sustainability, says: "We joined NextWave to play an active role in taking on the ocean plastic problem and



IMAGE: ORANGEBOX

cast a wide net for opportunities to incorporate ocean-bound plastic across our global operations. We're proud of the progress we've already made with packaging and textiles and are eager to continue doing our part in preventing harmful plastic from reaching our oceans by adding it to the iconic Aeron Chair."

The company says that, depending on configuration, the ocean-bound plastics in Aeron can be found in the frame and tilt covers of the chair amounting to between 0.5 and 2.5 lbs (226.8 g and 1.13 kg) of the material per chair. The Onyx Ultra Matte colorway contains the highest amount of ocean-bound plastics at almost 2.5 lbs (1.13 kg) per chair. All chairs within the Aeron Portfolio are up to 90% recyclable and composed of over 50% recycled content, it says.

While Herman Miller produces high-end furniture, another company of global stature - **IKEA** - dominates the affordable end of the market. It too has a sustainability focus in its product design and has the ambition to use only renewable and recycled materials by 2030. This focus was highlighted five years ago in the Odger chair. This injection moulded chair is made of wood-plastic composite comprising 30% wood chip from reclaimed wood and 70% PP with recycled content. Odger was designed for IKEA by Stockholm-based Form Us With Love.

"Renewable and recycled materials are prerequisites for a circular society," says Lena Pripp-Kovac, Head of Sustainability at the Inter IKEA Group, in the group's 2021 sustainability report. "In a world of limited resources, we want to move away from the linear model of 'take, make, waste', to a circular system where nothing is wasted and where old products become new resources. Our ambition is to inspire and enable our customers to live better everyday lives, within the limits of the planet, so the materials we use are a key aspect of this."

She says the group has "made some good

Below: Herman Miller says it has started using recycled plastics in its classic Aeron chair range



IMAGE: HERMAN MILLER

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progress. Currently, 60% of the materials IKEA uses are renewable and 10% are recycled... We already use a lot of renewable wood-based materials, and we're increasing the amount of recycled materials such as recycled plastic in our products."

No matter what the sustainability vision is of a designer or design-led company, recycled plastics are not a simple drop-in solution to replace virgin plastics. Contamination is a major issue for recycled plastics in consumer products, as Pripp-Kovac indicated when talking about the Trollbo children's lamp, which has a lampshade and other elements made from recycled PET bottles. "It's a challenge to make recycled plastic translucent. Our product development team had to play around with different grades of PET bottles to achieve this, but they succeeded in the end and the result is great," she said. It's also difficult to source clean recycled materials in enough quantity, she said.

Performance questions around recycled plastics informed furniture group **Muuto** in its reworking of the Fiber range of chairs originally launched in 2014. The shell seat is a wood-plastic composite and in its new iteration the plastic material includes recyclete.

"It might sound like a modest challenge, yet reproducing the same strength and durability as the forerunner was a result of diving into the wildly complex world of mechanics and material properties," says Trine Mulvad Steffensen, CSR Manager at Muuto, on the company's website. "After two years of intense research and development here we are - we have proved our initial hypothesis to be possible."

The Fiber armchair and side chair use a minimum of 80% recycled plastic. Muuto says it opted not to go for 100% recycled content because of concerns about lower strength. "To us it is a reasonable trade-off - creating a highly durable chair that will last for years to come, still using at least 80% recycled plastic. We believe that this will impact the environment less than creating a more frail chair with a shorter lifespan made in 100% recycled plastic," it says.

Leading furniture design group **Vitra** diverges from other companies and has not set itself recycled material targets. Instead, its approach to sustainability is to develop products that last as long as possible and it backs this up with long product warranties. Nora Fehlbaum, Vitra CEO, says: "Vitra's greatest contribution to sustainability is the creation of products that omit non-essential elements and last a long time. Our roots in modern design would allow nothing else."

This approach to quality design and longevity can



IMAGE: MUUTO

be seen in Vitra's Evo-C chair designed by Jasper Morrison in 2020. Evo-C is a cantilevered chair manufactured entirely from PP that is made possible through gas injection moulding technology. "There were many complexities," says Morrison, discussing the chair on his website. "The main struggles were the thickness of the legs, the length of the foot (to avoid tipping) and the detailing of how and where to end the gas-moulded tubular parts."

He continues: "There were many more struggles on the engineering side, and stress simulations which had the computers running for weeks to estimate whether the design was strong enough and if not then where it needed strengthening. Then there were test moulds of the legs to check them in reality, with snaking lengths of tube to simulate the flow of the gas through a certain length without building an expensive larger mould. Eventually when everything seemed to be working well enough they started cutting the mould which is a monster of moving parts and channels for the gas to get in. The achievement is nine

parts engineering to one part design. I think the final result has a Zelig-like ability to fit in to different kinds of spaces."

In order to design a successful cantilevered chair Morrison decided to avoid recycled plastics. He says on the Vitra website: "For the moment the chair would not be strong enough to be made

with post-consumer plastic, but no doubt the time will come when it could be. For now it's important to keep in mind that a well made and designed plastic chair has a useful life of 20-30 years and can be recycled after that."

Evo-C is a significant chair in design, engineering and manufacturing terms. Vitra's iconic cantilevered Panton chair from 1965 was the point of departure

Above: The seat shell of Muuto's Fiber range of chairs uses wood-plastic composite and in its new version the plastic material includes 80% recyclete

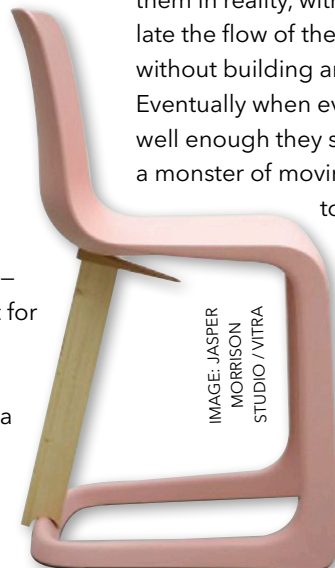


IMAGE: JASPER MORRISON STUDIO / VITRA

Left: The Vitra Evo-C chair during development

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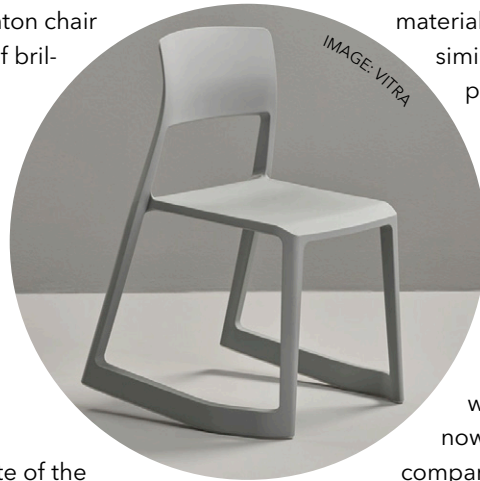
for Morrison. The monolith Panton chair was a landmark combination of brilliant design and engineering with plastic materials (which has been injection moulded in PP since 1999) and Morrison says he wanted Evo-C to also be a single plastic moulding, but this time with two front legs.

Vitra's focus may be on durability, but that does not mean it is ignoring recycled materials. Tip Ton Re, an update of the Tip Ton chair designed by Edward Barber and Jay Osgerby in 2011, is Vitra's first recycled plastic chair. It is injection moulded using 3.6 kg of recycled PP sourced from Germany's Yellow Bag household recycling scheme.

"Working on an existing product is a good way to gain experience with a new material," says Vitra's Chief Design Officer, Christian Grosen. "Though recycled polypropylene is still a type of plastic, it's different to work with."

He says the materials challenge was to make the chair strong enough, as recycled materials do not have the same performance as virgin. Glass was added to the PP for reinforcement, which then led to work on improving the surface quality. The company followed an iterative process to determine the minimum amount of glass fibre needed for strength while meeting the desired surface standards.

Another consideration for designers using recycle is what to do about its grey colour. Grosen says: "We wanted to keep the material as clean as possible, so what you see is what you get. There are tiny specks of other colours in the grey, which vary slightly from chair to chair. But for me that adds interest and pushes our perception of plastics. The slight variations in the recycled



material add depth and give it a story, similar to how the structure of a piece of wood tells you about the tree's growth cycles."

Grosen says product designers are facing a huge challenge in the way they approach materials and manufacturing. "You need a different mindset, but we are adapting to it, because it's the way we need to think and act now. It's part of the designer's and company's responsibility. In this

dialogue we push each other towards a more circular way of thinking."

He says: "Testing new materials and processes can give you unknown results; it always leads to some kind of learning and adds to the knowledge base on the circular economy. This is different from finding only a new aesthetic or a new function. We view this as a very relevant challenge. The rules are not yet written, and we are writing ours as we go."

Grosen describes plastic as "a fantastic material and will be with us for a long time, but there are right and wrong ways of using it. The critical thing is to understand when to use recycled plastic, when to use new material, and when to combine them to achieve products that people will keep and utilise for as long as possible."

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Left: Tip Ton Re is Vitra's update of the Tip Ton chair designed by Edward Barber and Jay Osgerby, using recycled PP

The chair that picks itself up off the floor



Recycled materials suppliers hope to show designers and specifiers what it's possible to do with recycle. In order to showcase its Circo recycled plastics, Fortum Recycling in Finland has designed a self-righting chair.

The Viren chair prototype has a clever design which allows it to roll and "stand" again after being knocked over. It is made using Circo recycled PP compound reinforced

with cellulose fibre and has a steel base plate. The carbon footprint of Fortum Circo recycled plastic is about half that of virgin plastics, says the company.

The chair was inspired by Finnish athlete Lasse Viren's recovery in the 10,000 metres final in the 1972 Olympics in Munich. After stumbling, Viren picked himself up and went on to win the race in record time.



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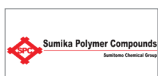
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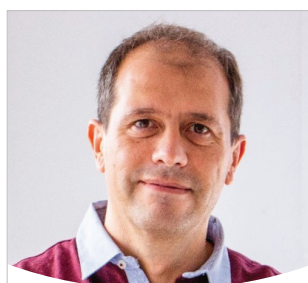
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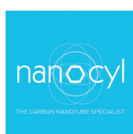


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The Thin Wall Integra project brings together experts to push the boundaries of moulding thin wall packaging. James Snodgrass writes about innovations in packaging and electronics moulding



IMAGE: ARBURG

Going further with thin wall moulding

As the trend towards lighter, stronger, higher volume packaging continues apace, thin-wall injection moulding continues to be a growth sector: with compounders making stronger and more sustainable PP and PP copolymer grades and processors finding ways to make walls ever thinner, and cycle times ever shorter.

Mordor Intelligence research indicates that the thin-wall packaging market was valued at \$38.58bn (€34.62bn) in 2020 and is expected to reach \$55.92bn (€50.18bn) by 2026, at a CAGR of 6% over the forecast period of 2021-2026. Research from Emergen is even more encouraging. The Canadian market intelligence company believes the market could reach \$66.75bn (€59.82) by 2027. Novel thin-wall moulding applications have also emerged within engineering thermoplastics for personal transportation and consumer electronics applications, where a combination of light weight and strength is as vital as it is for the packaging sector.

Co-operation between mould makers, robotics experts, IML label manufacturers, raw materials suppliers and an injection moulding machine manufacturer has resulted in the Thin Wall Integra project – a new approach to the production of thin-walled packaging. The novel production cell in Aulnay-sous-Bois, France, is a collaboration

between Collomb, a mould maker specialising in thin-walled containers; Pagès Group, a specialist in packaging robotics; Verstraete, an IML label manufacturer; Koch-Technik, a material flow specialist; Borealis, a raw materials supplier and the French subsidiary of German machine maker Arburg. Thin Wall Integra is intended to be a one-stop shop concept for the production of thin-walled five-litre buckets.

The concept is a fully automated injection moulding cell built around a hybrid **Arburg Allrounder 720 H** machine, in packaging variant, with a one-cavity mould. The complete cycle takes around 5s. Both the injection moulding machine and the sequentially operating robotic system are optimised for fast cycles. The handling system with telescopic arm that engages from the rear side of the machine first loads the mould with the IML labels. The robotic system then removes the finished labelled buckets and stacks them on a deposit mat. The stacks are then automatically picked up by a robot for palletising. The two robot technologies used make the system particularly compact. The granule (Borealis's UJ599MO-90, a compounded polyolefin solution containing 55% mechanically recovered post consumer recycle) is continuously fed in through an automatic

Main image:
In the Thin Wall Integra project, a fully automated injection moulding cell has been designed around a hybrid Arburg Allrounder 720 H in packaging version

Right: Arburg says a geometric structure moulded on the bucket's inside helps lessen vacuum effect when stacked and contributes towards compression resistance

conveyor system. The melt flow rate (MFR) is 70 in this specific application, according to an Arburg spokesperson.

The containers have a wall thickness of just 0.63mm, leading to material savings of up to 35% compared with similar 5-l containers. As is apparent from the photograph (right) - looking where the sun shines through the bucket from behind - the containers have a geometric pattern moulded on the inside. This is to contribute towards compression resistance and also to limit the vacuum effect when pails are nested in each other, by allowing increased air flow. Labels are produced with digital watermarking from the Holy Grail 2.0 project, making the pails recyclable anywhere that PP can be recycled.

Counterfeiting in the luxury food and drinks industry is a multi-million dollar industry. The pandemic added to the problem: there was a high demand for premium products but, at the same time, there were interrupted supply chains, receiving fewer physical audits. This created a situation ripe for opportunists and bootleggers, who took advantage of the disruptions.

Sumitomo (SHI) Demag has been looking at how specialist closure and thin wall moulders are applying the latest injection moulding precision and IML techniques to step up their fight against the creative food and drink fakers to mitigate risks and safeguard brand integrity.

In a recent survey of senior food and drink executives conducted by assurance specialists Lloyd's Register, only one-third admitted to vetting suppliers against a recognised GFSI standard. One in five declared that no checks were made as part of sourcing decisions. Yet, despite these prevalent risks, 97% stated that they had been affected by food fraud in the last 12 months. Few in the industry regard authenticating products as their highest priority.

Looking at the UK food and drink market, Sumitomo (SHI) Demag UK packaging specialist, Ashlee Gough, notes that it remains one of the worst markets for counterfeiting - when food and drink products are deliberately packaged to deceive consumers. The UK Food Standard

Agency's National Food Crime Unit estimates that the combination of

Tamper evident closures is one method deployed by packaging manufacturers to counteract fraud in the premium drinks, wellbeing and pharmaceutical markets



IMAGE: ARBURG

adulteration, substitution, theft, misrepresentation, illegal processing, waste diversion and document fraud costs £11.97bn (£14.33bn) per annum.

Seizures of counterfeit products provide a good indication of the scale of the problem. In 2020, Operation Opson IX seized 12,000 tonnes of illegal and potentially harmful products, including 1.2m litres of alcohol.

In a concerted effort to crack down on groups profiting from illicit versions of branded spirits and premium foods, manufacturers are making labels more difficult to copy and bottles harder to refill. "One way to counteract counterfeiting and product tampering is through the innovative design of packaging that cannot be easily copied," says Gough.

"Until recently, this may have involved putting shrink or foil sleeve around a luxury drink brand, for example. Closure moulders especially are stepping up their efforts and investing in dedicated cells to produce high quality and anti-refill closures made up of a number of complex parts." Due to the intricacy of these closures, moulding precision is paramount.

Significant investment in high quality tooling, automation, machinery and expertise can be another major deterrent, says Gough. "Realistically, few counterfeit operators would make the level of investment required to replicate this level of technical precision."

Other covert packaging methods to deter counterfeits include concealing unique identifiers, such as a QR code, holograms or tags within the IML. While these can assist with track and tracing, Gough claims that they only really help to validate the origin of a container and tend to be more widely deployed by luxury food, cosmetics, pharmaceutical and wellbeing brands.



IMAGE: ISTOCK/
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He says: "To outsmart quick-witted counterfeiters, manufacturers may need to deploy several tactics simultaneously to prevent brand value being diluted, including tamper evident bands, secure closures, snap buttons, barcoded labels and batch codes, and even chemical markers."

For packaging moulders producing thin-walled containers, or caps and closures, by the million, cost effectiveness remains vital. Gough highlights Sumitomo (SHI) Demag's EL-Exis SP range which, the company claims, typically achieves between 3% and 5% greater productivity compared with other packaging machines on the market. The fourth generation EL-Exis SP series is designed to withstand the higher stresses and injection pressures that are necessary for achieving repeatability in closures and thin-walled packaging products, while maintaining comparable mechanical properties.

At the time of writing, access to two new grades of PP impact copolymer, from Azerbaijan-based **Socar Polymer**, may be influenced by geopolitical events. However, they are currently marketed to customers in Russia, Turkey and CIS (Russia plus eight former Soviet republics of Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan and Uzbekistan).

Socar Polymer's CB4848 MO and CB 6448 grades are designed for rigid, thin-wall packaging such as caps, closures, and opaque containers, as well as for various housewares, sporting goods, and toys. Containing **Milliken Chemical's** Hyperform HPN additive, the CB 4848 MO (with MFR of 48) and CB 6448 MO (with MFR of 64) grades deliver moulded parts that the company claims



IMAGE: SOCAR

exhibit low shrinkage, improved thermal resistance, superior rigidity, dimensional stability, and a balance between stiffness and impact resistance.

Socar Polymer worked collaboratively with Milliken for a year to provide customers with these reactor grades of heterophasic copolymers, which use no organic peroxides, and are consistent with the company's "zero-phthalate philosophy". No catalysts or chemicals containing phthalate compounds are used at any stage of production. This latest collaboration built upon previous cooperation between the companies that led to the introduction of Socar's first two random copolymer PP grades - RB 4545 MO and RB 6545 MO. Those grades use Milliken's Millad NX 8000 family of clarifiers to boost clarity in thin wall injection moulded packaging products while maintaining a balance of overall properties.

Milliken additives were also involved in the development of a new PP impact copolymer from US-based producer **Flint Hills Resources**. The American PP manufacturer's new impact copolymer, AP5195-LV PP, is designed to deliver better impact strength, high melt flow and good stiffness. This is achieved using DeltaMax performance modifier from Milliken.

"The balanced performance of Milliken's additive technology enhances the resin architecture of our new AP5195-LV PP impact copolymer," says Pierre Donaldson, Director of PP R&D for Flint Hills Resources. "By excelling in impact, melt flow and stiffness, our novel PP material can make it easier for converters to produce strong yet lightweight packaging, boost productivity, and reduce energy and plastic use to support environmental efforts. This new grade is an important addition to our portfolio and represents another major milestone in our successful collaboration with Milliken."

Brian Burton, Regional Director of Sales for Milliken, says: "As one of the first resin suppliers to utilise our newest performance modifier, Flint Hills

Above:
Socar's new compounds for thin wall packaging contain Milliken Chemical's Hyperform HPN additive

Left: IML labels with unique identifiers, such as a QR code, holograms or tags, are other methods that can deter counterfeiting, says Sumitomo (SHI) Demag



IMAGE: SUMITOMO (SHI) DEMAG

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Composite materials

To demonstrate thin-wall applications for its Tepex Dynalite continuous-fibre-reinforced thermoplastic composites, **Lanxess** has looked to an electric skateboard that uses Tepex Dynalite overmoulded with polyamide. Electric skateboards are, Lanxess contends, extremely challenging to design.

The electric components of a skateboard, such as the battery and the motors that drive the wheels, need to be housed in very confined spaces to keep the board light, compact and easy for the rider to handle. **EMI** is a family business based in France that manufactures the Okmos SL-01 electric skateboards.

Conventional skateboards usually consist of a relatively flat wooden board where the rider stands, also known as the deck. Under the deck of electric skateboards is a plastic box containing equipment including the battery. The EMI design, however, has a trough-shaped deck. With the exception of the motors - which are mounted on the back of the skateboard - the trough houses all the electric and electronic functions, including the battery. The trough is enclosed by a cover. Because of the strength of the Tepex reinforced composite, the trough can be manufactured with a wall thickness of just 3mm.

"Tepex is extremely resilient thanks to its high torsional and bending strength, and very lightweight into the bargain. The deck weighs just 2.5 kg," says Jean-Marie Olivé, Technical Manager Application Development at the High Performance Materials (HPM) business unit at Lanxess. "Despite the thin walls, the electric and electronic components in the deck are safely protected against impact as well as moisture."

The trough-shaped composite part is manufactured in a single hybrid moulding process step. First, a robot inserts the metal base plate used to attach the truck axles into an injection moulding tool. It then places a heated and plasticised Tepex section in the tool. In



Above: The Okmos electric skateboard is manufactured by EMI in France

one operation, the section is then formed and the entire structure overmoulded with a short-glass-fibre-reinforced PA6 compound.

"The process is very efficient and highly integrated, meaning that not only can the base plate be fixed in place, but fastening elements, wire ducting and the battery holder can also be mounted in the same operation. That means that unlike many conventional electric skateboards, the latter does not have to be screwed in separately," says Jules Staedelin, R&D Manager at EMI.

The composite section is made from PA6-based Tepex Dynalite 102-RG600(6), which is reinforced with six layers of continuous-glass-fibre rovings. The deck cover is also made from this material. Lanxess PA6 grade Durethan BKV30H2.0EF is used for overmoulding. This compound, which contains

30% short glass fibres by weight, is optimised for

this purpose. Its melt flows easily, which ensures that even long flow paths can be implemented without problems when the injection moulding tool is being filled.

EMI has developed its new electric skateboards entirely in France, and it manufactures them there as well, under the Okmos brand. The injection moulding tool for the hybrid moulding process is also based on in-house expertise.

Left: The trough containing the battery and electronics for the Okmos skateboard has a wall thickness of just 3mm



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IMAGE: MAGUIRE

More control, less hot air in material dryers

Manufacturers are putting continuous innovation at the forefront of material drying technology. Peter Mapleston takes a look at new offerings from suppliers

Plastics processors want more from their drying equipment – and suppliers are obliging. Injection moulding companies are feeling a greater need to properly look after their feedstocks, as prices and delivery times rise for many polymers. With the increase in business, and global supply chains showing weaknesses, many equipment manufacturers are revisiting their product lines to make beneficial changes that will pay off over the next several years, says the head of one major dryer manufacturer.

"We need to keep that continuous improvement process moving forward. It will only make the product better," says Jason Sears, President of **Dri-Air Industries**. Many of those improvements are in controls and communications, fit for smart factories kitted out for the Internet of Things (IoT), alternatively called Industry 4.0.

Latest development from Dri-Air is the Smart-Touch Control (see also *Injection World* March 2021). Sears describes it as an operator friendly control system that has reporting and trending which allows documentation of the processes

along with diagnostic capabilities for use by maintenance staff.

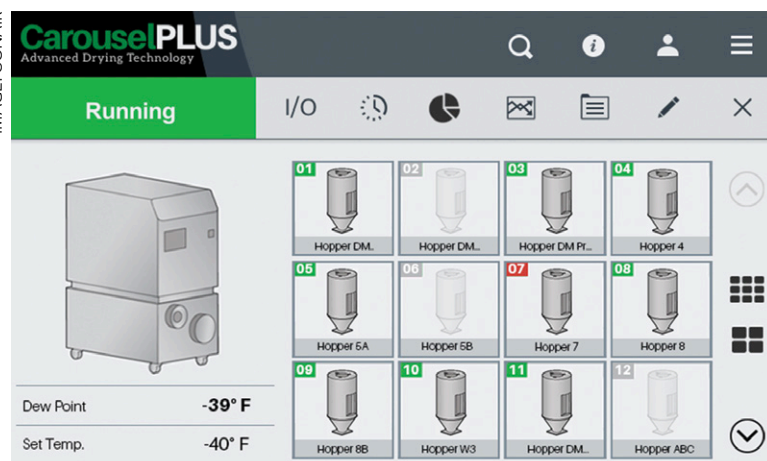
Dri-Air has two models of dryers, the Arid-X and HP4-X dryers. The Arid-X dryer has been the company's standard two bed dryer since 1985. For situations involving high levels of moisture materials and/or environments that are overly humid, Dri-Air recommends the HP4-X four-bed dryer.

SmartTouch Control is now available for hopper banks which Sears says opens up the communications along with the diagnostics and trending. Hopper banks are built to order and can also be used with an existing dryer. "With material throughputs dropping in many areas, there are surplus dryers in a company. The larger sized dryers can be matched to a hopper bank that will utilise the forgotten, larger dryers to address smaller throughput applications."

Last year, **Conair** (now part of the Piovan Group, but expected to continue operating as a separate entity) rolled out a new control platform for its various auxiliaries, featuring an HMI that it says offers a consistent user experience (menu, naviga-

Main image:
A group of
Maguire Ultra
dryers in a
centralised
drying and
distribution
set-up

IMAGE: CONAIR



Above: To simplify training and operation of many types of auxiliary equipment, Conair is implementing a new "common control" platform, featuring an HMI that offers a consistent user experience (menu, navigation, data entry, notifications, icons, colours, communications) regardless of the machinery involved. The common HMI is also used by the Machine Control view of SmartServices for remote control of various auxiliary equipment

tion, data entry, notifications, icons, colours, communications) regardless of the machinery involved. They have been implemented in such equipment as Conair's SmartFLX material handling control, blenders, chillers and temperature-control units, as well as its dryers.

All are compatible with SmartServices, Conair's cloud-based IoT solution for machine monitoring and data collection. The Machine Control portion of SmartServices mirrors the same control screen that an on-the-floor operator would see. This means that anyone logging into the SmartServices dashboard and using the Machine Control feature will be familiar with the screen setup and basic operation of the various pieces of connected equipment.

Drying Products Manager AJ Zambanini says: "All the buttons will be in the same place, with the same names and colour schemes, which will require very little training for an operator as they train on different equipment. We believe this is the first time any supplier has offered all the major pieces of equipment and central control systems with a common, consistent look and feel from the operator's perspective."

The OPC Unified Architecture (OPC UA) data-exchange standard is the primary protocol for Conair machine controls. Conair says that because not so many processors are yet using OPC UA, MODBUS and other standards also continue to be supported.

"Customers are demanding more, and rightfully so," says Zambanini. "While simple, low-tech solutions remain an industry staple, more custom-

ers of all sizes are demanding more from their drying systems."

Zambanini says that in response to growing demand for Industry 4.0 solutions that allow for centralised monitoring and management of auxiliary equipment, Conair continues to improve its SmartServices web-based equipment monitoring platform. This platform allows users to monitor, analyse, and control virtually every aspect of their process remotely.

Another major industry trend driving developments, Zambanini says, is the increased use of bio-based polymers, which can provide new challenges. "It is not uncommon, for example, to see biopolymers off-gas VOCs or contaminants like recycled resins do. To manage this problem, Conair offers demisters, sometimes called volatile traps, which are vital to maintaining a healthy dryer."

He says: "Many biopolymers also require lower drying temperatures, since using too high a temperature can damage the materials or lead to increased VOC release. All standard Conair drying equipment is capable of running a range of temperatures from 65.5°C to 190°C and includes all necessary aftercoolers to handle these lower drying temperatures."

Zambanini also highlights how Conair equipment continues to evolve in response to needs to cut operating costs and reduce maintenance. For example, by using independent process and regeneration blowers, Conair dryers achieve a very stable process unaffected by ambient conditions, he says. Temperature feedback from the material in the hopper is used to adjust the blower speed and air flow.

Clustering material drying and preconditioning at a central location can yield a range of extra benefits for growing processors. A single point of preconditioning control for multiple machine

Right: Koch-Technik's KKT mobile granulate dryers come with a new touch control



IMAGE: KOCH-TECHNIK

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locations eliminates the need to move back and forth between machine-side dryer and hopper locations to change settings. And it obviously frees up space around processing equipment.

At the last Fakuma show in Friedrichshafen, Germany, in October 2021, **Koch-Technik** showed its Eko-N dry air dryer, which was presented in its original version at K 2019. The dryer has been developed further with respect to energy efficiency. Together with the company's Koch-Öko energy system control, the new dryers can save up to 50% energy.

Koch also showed its KKT mobile granulate dryers with a new touch control. The new colour displays are larger than before and provide simple, intuitive operation of the control unit, the integrated central conveying system - which can communicate with other equipment as a result of the OPC UA communication standard - and the option of full integration into the Koch visualisation.

Motan-Colortronic exhibited a new Luxor SG 50 dry air dryer at Fakuma 2021. This is the first mobile and compact dry air dryer in the company's new Luxor SG series. The dry air generator comes with a dry air capacity of 50 m³ per hour and is connected to a single drying bin with 150 litres capacity. Additional functions include a dew point display and the ecoProtect material protection function. An integrated microprocessor control manages the dry air generator and the drying bin. A 7-inch graphic display allows all drying functions to be clearly shown and monitored.

Compressed air dryers in the CARD series were added to **Wittmann's** product portfolio in 2020. At Fakuma 2021, it showed the two most recent additions, the CARD primus 10 and the CARD primus 20. Card primus appliances are offered as package solutions, each including a VacuJet material loader with delivery hose and suction lance as well as the dryer itself. They come with drying silos of 10 and 20 litres capacity respectively, and are suitable for temperatures of up to 200°C. All CARD dryers work without desiccants.

Drying temperature can be set via a touch screen operating panel, and at the end of the pre-drying phase a signal is issued to release an automatic production start-up. The material drying data can be exported via a USB port or via OPC UA.



IMAGE: WITTMANN

Wittmann says that an integrated week timer makes it possible to adapt the use of the dryers to production planning; they can be made ready to run as soon as dried material is required. "In the CARD primus models, the compressed air consumption is very finely and precisely adjusted to the actual demand by an intelligent digital air volume control system," it adds. The VacuJet loader ensures a continuous material supply.

CARD dryers can be mounted directly onto the machine feed. In combination with a claw flange, the appliances can be pushed into a parking or emptying position. Use of quick-change adapters saves time when transferring the dryers from one machine to another.

Vacuum dryers provide another alternative to dryers that use desiccants to dry the hot air. Whereas the latter keep the hot air in a closed system and then dry it with desiccants when it becomes too wet to do its job, vacuum dryers don't recirculate and redry the air because the lower temperatures they use don't merit the expense.

Maguire debuted its offering at the beginning of the century. Chris Crittenden, Director of Maguire Europe, says the technology was originally developed as an answer to two problems associated with desiccant dryers: their relatively poor energy efficiency, and the time they need to get fully into action (as the material heats up). He says Maguire dryers were the first to make use of the fact that water can be driven off from wet material faster if the ambient pressure is reduced.

The LPD (Low Pressure Dryer) models, launched in 2000, were capable of drying materials like polycarbonate and PET in a fraction of the time needed for desiccant

dryers then available, but with their design incorporating three cannisters on a single carousel, for preheating, vacuum, and dispensing respectively, when it comes to applications with larger throughput requirements, they do not provide maximum flexibility in terms of the time taken for each stage, resulting in less than optimal energy consumption. On request, Maguire still offers three LPD models, with maximum throughputs of 14, 45, and 90 kg/h.



IMAGE: MOTAN

Above: Motan Luxor SG 50 compact mobile dry air dryer with a Metro G hopper loader

Left: Wittmann's CARD primus 20 compressed air dryer with FIT control and VacuJet loader

Right: Single Ultra dryer from Maguire throat-mounted for feeding PET to a preform injection moulding system

The VBD (Vacuum Batch Dryer) series, which came out in 2010, remedied this problem, with a vertical arrangement and larger heating hoppers. The VBD range has since evolved into the Ultra range, with upgrades such as load cells that enabled real-time monitoring of moisture levels, and with smarter controls that enable scheduling of drying operations. Maximum throughputs range from 50 up to 500 kg/h. K 2019 saw the introduction of the medium-sized Ultra 600 model, and there are indications that K 2022 will see a further development aimed particularly at larger PET preform producers.

Crittenden notes that outside PET processing, the biggest call for dryers from injection moulders comes from those processing polyamides. These present a particular challenge, he says, because there are so many different formulations, based in different polymers, and they all behave differently. "Drying can take up to a day with a desiccant dryer," he says. "An Ultra dryer can do it in an hour."

Despite the fact that vacuum dryers have been on the market for over 20 years, they are still a niche product. One reason may be that Maguire has ring-fenced its IP, so it is almost alone in the



IMAGE: MAGUIRE



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market offering this type of technology. Crittenden says investment costs are similar to those of top-end desiccant dryers, and from then on, it's downhill all the way with savings of up to 90% in energy bills. "Enquiries are increasing and we are getting a lot of repeat business now," he says.

Maguire is not completely alone with vacuum dryers though. **Matsui** has for several years offered the DPD3.1 in its "plas-aid" product line. It says energy consumption is half that of standard dehumidifying dryers, and that the DPD3.1 is also constructed to prevent the radiation of heat.

Matsui says: "In addition to this, the high-thermal conduction method helps improving [part] quality. It prevents effectively yellowing and oxidation of the end products. Thermal conduction fins in the inner hopper are located at both the inner and central wall of the hopper. Sensors are also located at various points to ensure speedy temperature control for efficient drying."

The company says: "The vacuum drying process pulls out much of the contamination that can clog pins and vents [in the mould], which reduces the frequency of cleaning and maintenance. Also, due to the unique design, the maintenance process is made extremely easy. Thanks to the smooth surface of the extruded fins, materials do not stick onto the hopper and cleaning can be carried out quick and easily."

Maintenance tips

With the summer months coming up in the Northern Hemisphere, Dri-Air President Jason Spears says this could be a good time to look at some preventive maintenance for dryers. Here are some of his tips.

Regardless of the type of desiccant dryer, all change internally between regeneration (removing the moisture from the drying media) and process (removing the moisture from the plastic). Warm, humid weather puts a strain on both phases.

On the process side (the side that sends dry air to the drying hopper) cracked or crushed hoses, missing hopper covers, and missing hopper door gaskets are areas where the warm, humid air can infiltrate the system, loading the desiccant beds with moisture that leads to high dewpoints. Clean filters are also important, as dirty filters will restrict air flow and cause extended drying times.



On the regeneration side, clean filters are a key component in providing adequate air flow to regenerate the desiccant beds quickly. Filters can not only be contaminated by dust and fines, but also by any volatiles such as plasticisers condensing on the filter. So it's a good idea to change the filters on a regular basis.

As a rule of thumb, if you are processing only virgin resins, change your filters every six months, says Spears. If you are processing regrind or resins with a high glass content, his advice is to set up a schedule based on physical appearance.

To stop the volatiles from contaminating filters (and possibly the desiccant beds) the dryer will need an after-cooler and volatiles trap. If the dryer already has a trap and cooler assembly, and volatiles are still an issue, check with your material supplier to make sure you are using the correct drying temperature. If the dryer is operating just a few degrees over the recommended drying temperature there can be a major impact on how much plasticizer is released from the resin.

Reduction in airflow from clogged filters also causes the problem of inhibiting regeneration which can lead to high dewpoints and temperature spikes if your dryer does not control regeneration based on temperature, says Spears.

While checking the dryer filter, also inspect the filter housing – check for missing gaskets, lid retaining fasteners etc. Check the lid fits correctly. If your dryer is equipped with a return air heat exchanger or aftercooler, you should also inspect the heat exchanger for blockage.

Material storage is another important area. Keep bags sealed as long as possible and put any unused material into sealed containers – materials like glass filled polyamides and some polyurethanes can require 16-hour dry times if left in an open environment.

Left: Matsui's DPD3.1 vacuum dryer. It is available in two versions, one with an 11 litre hopper and the other with a 25 litre hopper

CLICK ON THE LINKS FOR MORE INFORMATION:

- > <https://dri-air.com>
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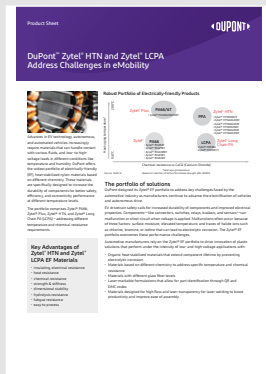
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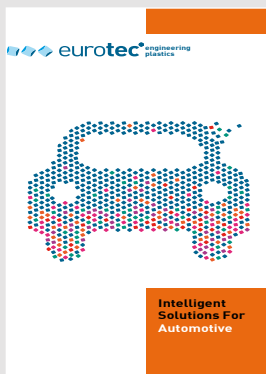
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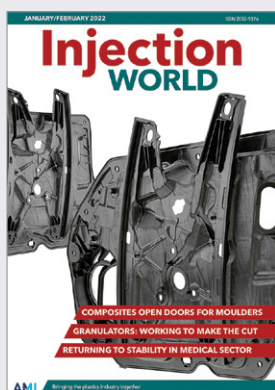
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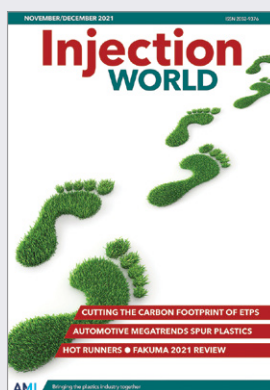
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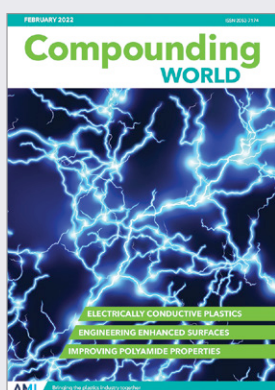
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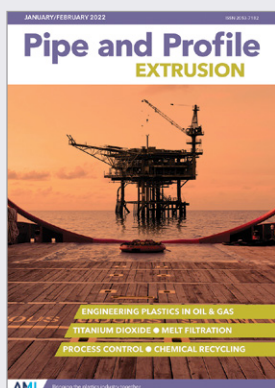
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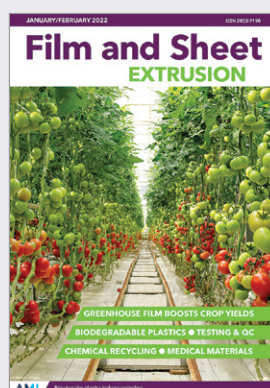
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