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Injection WORLD

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NPE draws 56,000 visitors

More than 56,000 visitors from 19,000 different companies attended NPE 2018, North America's biggest plastics trade show that took place in Orlando, Florida, last month. The figure was 1.7% higher than the previous NPE in 2015 and a record for the third NPE show event at the Florida location, according to organiser, The Plastics Industry Association (it had previously set a target of 65,000 but said external analysis showed 2015 attendance had inadvertently been overstated).

The show also set exhibitor records, with 2,174 exhibitor companies taking some 111,000m² of floor space.

"We sold out our exhibit floor nearly 14 months in advance of the show and worked diligently to accommodate the companies who were unable to secure space during our Space Draw," said Plastics Industry Association President and CEO William R Carteaux.

› **www.npe.org**

Ningbo Jifeng Auto Parts is seeking approval for its offer from Grammer shareholders

Grammer agrees to Chinese takeover bid

Grammer, the Germany-based supplier of components for automotive interiors and commercial vehicles seating systems, has concluded a comprehensive agreement, under which a German affiliate of Ningbo Jifeng Auto Parts will launch a €60/share offer for its entire stock. Separately, Grammer has signed a contract to acquire Toledo Moulding & Die (TMD) in the US.

The buyout will require the approval of at least 50% plus one of the Grammer shareholding and has been recommended by the executive board. Grammer said that the aim is to strengthen the two companies' strategic partnership, stabilise the shareholder structure, optimise the global footprint and secure its global growth strategy.

As and when the takeover is complete, Grammer will remain listed on the German stock exchange, retain its headquarters and all its locations and make "extensive commitments" to all employees, giving them security for up to 7.5 years, it said.

Ningbo Jifeng, which is owned by the Wang family, already has a stake in Grammer. It has agreed not to begin any structural measures like a spin-off or delisting, unless the executive and supervisory boards approve.

Grammer said the combination will give it better access to the Chinese market, while Ningbo Jifeng benefits from Grammer's international positioning.

Grammer said its acquisition of TMD, based in Toledo, Ohio, is in line with its strategy of acquiring technology companies to enhance its own product range and process expertise. TMD is a specialist in the development and production of mainly interior parts for the North American automotive market. In 2017, it had sales of $300m and about 1,600 employees at 11 facilities in the US and Mexico, including 100 engineers at two developments sites. The deal is expected to close in Q3, subject to antitrust and other approvals.

› **www.grammer.com**

Webasto buys AeroVironment unit in US

German automotive supplier Webasto has agreed to buy the Efficient Energy Systems (EES) business segment of AeroVironment of Monrovia, California, which is now focusing on unmanned aircraft systems and tactical missile systems. The transaction price is $35m.

Adding EES business, it is claimed, will strengthen Webasto in its core businesses of sunroofs, convertibles and thermo systems, while enabling it to move into new business areas like battery systems and plug-in electric vehicle charging systems. The company, which is one of the top 100 automotive suppliers, had sales of €3.2bn and employed over 12,000 people in 2016.

› **www.webasto-group.com**

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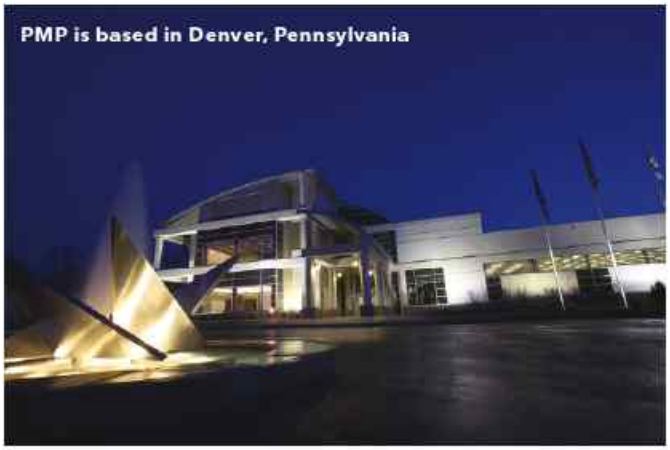
Röchling acquires PMP medical moulder in US

Röchling is to acquire Precision Medical Products (PMP) of Denver, Pennsylvania, in the US. PMP, which employs 120 people, is a medical technology specialist, with a wide range of services that include outsourced injection moulding for OEMs. It has grown in particular through its ability to make high-quality precision components with extremely narrow tolerances.



PMP is based in Denver, Pennsylvania

"The combination of our injection moulding expertise with PMP's expertise in metal and fine precision technology will enable us to offer medical technology manufacturers in North America a broader range of services than before," said Lewis H. Carter, president of Röchling Advent Tool & Mold and head of the Medical Plastics business unit.

This acquisition further expands the medical division of the Röchling Group, which offers standard and custom plastic products for pharmaceutical, diagnostic, surgical and life science applications. Hitherto, Röchling Advent Tool & Mold, a full-service specialist in injection moulded plastic medical components based in Rochester, New York, had been the only Röchling Medical location in North America.

› **www.roechling.com**

LyondellBasell in Braskem talks

LyondellBasell has entered into exclusive discussions with Odebrecht, the controlling shareholder of Braskem, regarding a potential transaction between LyondellBasell and Braskem.

In a June 15 statement, the companies said the discussions were preliminary. The companies needed to complete appropriate diligence, negotiate definitive agreements and obtain corporate approvals. They said they could give no assurance the discussions will result in a transaction.

› **www.lyondellbasell.com**
› **www.braskem.com**

RPC shows big growth in sales

Rigid packaging major RPC Group saw a 36% growth in sales to £3.75bn in the year to 31 March. This was mostly driven by acquisitions, supplemented by 2.8% organic growth. Adjusted profit was up 38% to £425m.

Chairman Jamie Pike said that the company had "continued to deliver its Vision 2020 strategy, which targets a balanced portfolio of cash generating and growth markets and draws on the strength of both customer and supplier relationships". The management has particularly been seeking acquisitions outside the packaging market.

It also acquired Nordfolien for €75m in a deal that was completed after the year ended, as well as Letica and Astrapak outside Europe. The firm has 189 operating sites in 34 countries and non-European sales account for 22% of revenues.

› **www.rpc-group.com**

Sumitomo (SHI) Demag works with Piovan

Under an agreement that began last year, moulding machinery manufacturer Sumitomo (SHI) Demag and Italy's Piovan Group will develop and market complete systems, including machines and Piovan downstream equipment like the Aquatech cooling systems.

Sumitomo (SHI) Demag will take on board the equipment at its European technical centres, as this allows them to offer customers the complete portfolio if required. The relevant equipment was chosen from Piovan's general portfolio and adapted to suit the Sumitomo (SHI) Demag machine series.

The two companies said they will mainly target the packaging industry, particularly injection moulding applications like thin-wall products and closures. The cooperation will initially cater to Europe but will in time be global. They have already exhibited systems combining their respective offers at Chinaplas in Shanghai and NPE in Orlando this year.

› **www.sumitomo-shi-demag.eu/**
› **www.piovan.com**

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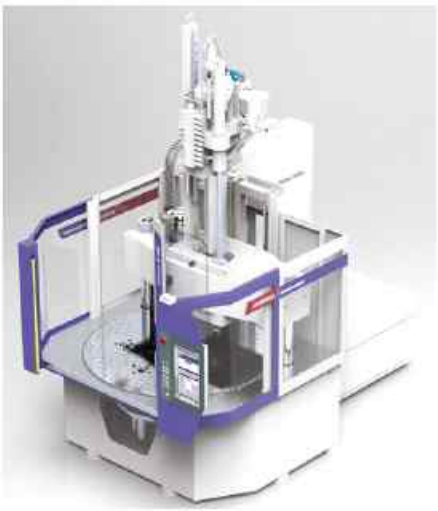
Wittmann Battenfeld to launch new VPower vertical machines

Wittmann Battenfeld is preparing to introduce the VPower series of vertical injection moulding machines. The Austrian company said it expects to launch the new machines at Fakuma 2018 in October, but it gave customers a preview at an event at its Kottingbrunn facility on June 13 and 14 to celebrate the 10th anniversary of Wittmann Group acquiring Battenfeld.

On display was a prototype VPower 160/750 machine with a rotary table 1,600 mm in diameter and with a servo-electric drive. The company says the machine has a smaller footprint than the predecessor model, it has a low working height, and its larger servo-electric rotary table ensures short rotary times. The VPower machine also has no central tie-bar, which makes it possible to install central media supply from below.

Wittmann Battenfeld also rolled out a larger machine in its servo-hydraulic SmartPower series, in response to customer demand. The SmartPower Combimould will be available with clamping forces of 600-4,000 kN. Each injection unit has its own servo-hydraulic drive, which, Wittmann Battenfeld said, gives it "ultimate energy-efficiency and independent, parallel operation of all injection aggregates", for short cycle times and low energy consumption.



A prototype of the new VPower 160/750 was shown at Wittmann Battenfeld's 10th anniversary event in Kottingbrunn

At the event Wittman Battenfeld announced plans for two more extensions at the Kottingbrunn facility. The projects will add 3,000m² for an automated logistics centre and production of vertical and special machines, and 2,600m² of office space will be built for engineering, production and quality departments. In June, visitors were able to see the facility's expanded north and south halls, tech centre and offices that were completed in recent months.

Dr Werner Wittmann, the founder of Wittmann Group, was one of the speakers presenting at the anniversary event which celebrated the collaboration of Battenfeld and the Wittmann Group over ten years. "We are really proud of what we have achieved together," he said.

› **www.wittmann-group.com**

Tableware firm sold in the US

New ThermoServ has completed the previously announced acquisition of Capital Cups from CSP Technologies and will move production of insulated tumblers for the retail, food, restaurant and convenience stores to its own site in Dallas. The acquisition supports New ThermoServ's diversification into casual dinnerware and tabletop accessories.

› **www.thermoserv.com**

Motan China moves to larger site

China's Motan-Colortronic Plastics Machinery has moved some of its operations to a larger, 4,600 m² building at Taicang in Jiangsu province, about 50 km north-west of Shanghai. The company has been present in China since 1999 and has had a production site at Taicang since 2006. It also has subsidiaries in Singapore and Thailand.

The new headquarters will act as a sales and production centre for all of South-East Asia, while enabling Motan-Colortronic to make all of its product lines in China. As well as the sales and production building, the site features a technical centre for testing raw materials handing applications and for customers to train their own employees.

The Motan Group has sites in Germany, India and China, turning over about €119m annually. It is active in injection moulding, blow moulding, extrusion and compounding, including system solutions for storage, drying and crystallisation, conveying, dosing and mixing of raw materials.

› **www.motan.com**

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PolyOne buys PlastiComp to target LFT potential

PolyOne Corporation has continued its strategy of growth through targeted acquisition by buying US-based PlastiComp, a specialist in long fibre technology (LFT) composite formulations and production.

Founded in 2003, PlastiComp is best known for its Complēt product lines, which include long glass, carbon and hybrid reinforcements of up to 50% in matrix materials ranging from PP to PEEK. The materials are used in a variety of demanding applications in markets including medical, automotive, marine and outdoor equipment.

PlastiComp employs around 50 people at its plant at Winona, Minnesota, and operates six LFT pultrusion lines, two for carbon and four for glass products. The business and all staff, including founder Stephen Bowen, will become part of PolyOne's Specialty Engineered Materials segment.

"We are very excited to accelerate commercial and operational investments to further expand this important composite technology as part of our advanced composites portfolio," said Robert M Patterson, Chairman, President and CEO of PolyOne.

LFT-based materials are increasingly being used in metal replacement and light-weighting projects where they are said to offer higher strength and stiffness, greater design freedom, fatigue endurance, improved corrosion and wear resistance, EMI shielding and simple recyclability.

› **www.polyone.com**

› **www.plasticomp.com**

PHOTO: POLYONE

PlastiComp installed its second carbon fibre LFT production line in 2017

NEWS IN BRIEF...

MGI Coutier has rebranded itself as Akwel. The company said that "this unifying identity marks a new drive forward for the group, in line with the dynamic profile of Akwel".

Akwel topped the €1bn mark in sales for the first time in 2017 and now employs nearly 11,000 people across 42 sites in 22 countries. It is in the process of opening two new production sites in Thailand in 2018 and in Bulgaria in 2020, by when sales are predicted to be €1.2bn.

› **www.akwel-automotive.com**

International Automotive Components (IAC) has appointed Natale Rea as president and interim CEO, replacing Robert S. Miller, who has retired. Rea has been in the business for over 40 years, including six as president of the Automotive division at Martinrea International.

› **www.iacgroup.com**

Westfall goes east with purchase of NPI

Westfall Technik – a recently formed global holding company that is active in plastics for the medical, packaging and consumer goods industries and headed by former Netstal America president and Flextronics executive Rick Shaffer – has bought NPI Medical of Ansonia, Connecticut, in the US.

This is Westfall's first injection moulding operation on the US East Coast. Acquiring NPI will, it is claimed, "enhance the process of improving time to market for the medical device and disposable market" while working with seven other Westfall sites on the "prototype to production" concept.

NPI Medical's site covers nearly 5,600 m², which could be expanded to over 9,000 m². It has both clean room and white room moulding, primarily for moulding medical devices and disposables. There are 46 injection moulding machines, with 28 to 330 tonnes of clamping force.

The company moved to Ansonia in 1999 and focused entirely on medical applications. Modernisation plans are already in place for the moulding and tooling facilities.

› **www.westfall-technik.com**

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Advancing Possible

KraussMaffei forms digital unit

Machinery giant KraussMaffei is expanding its portfolio to include digital services and products. A new Digital Service Solutions business unit will develop and market new offers, as well as the classic service offer. In a related development, the group is taking a stake in Gindumac, a trader in second-hand plastics and metal machinery.

The digital services will include individual data analytics, platform-based machine control, connectivity and new plug-and-play offers. As of 1 July, the new unit will be headed by Nadine Despineux, currently Vice President of Sales in KraussMaffei Injection Moulding Machinery. She will also take a seat on the KraussMaffei executive committee.

The KraussMaffei Competence Forum in Munich on June 6 and 7 received more than 1,800 visitors. In addition to showcasing injection moulding, extrusion and reaction process technology, the event celebrated the group's 180th anniversary

"We are fully focusing on the needs of our customers which also includes a wider digital offering," said Frank Stieler, CEO of the KraussMaffei Group. "In close collaboration with our customers we are deepening our existing offerings such as in predictive maintenance and are establishing new offerings around platform-based analytics."

The company added that buying into Gindumac, gives it "the potential to win new customers and enter the second-hand machinery market with digital sales". In addition, it will "be able to fully map the lifecycle of used plastics processing machinery" and add a rental model for second-hand machinery.

Gindumac, whose name means 'Global Industrial Machinery Cluster', is based in Kaiserslautern, Germany, and has other offices in Spain and India.

› **www.kraussmaffei.com**

Fibrax enters Morocco

UK plastic and rubber moulder Fibrax has established a facility in Morocco, to go with existing sites in the UK and Poland.

It will operate as Morocco Precision Moulding at a 3,250m² manufacturing site, which currently employs 60 and has scope for expansion. Fibrax had been active here since 2012, working with a local partner.

It has recently seen a surge in demand for high quality automotive parts in North Africa.

› **www.fibrax.com**

Gerresheimer expands in Brazil

The Gerresheimer Anápolis plant in Brazil's Goiás state

Gerresheimer, the German-based supplier of speciality plastic packaging for pharmaceutical applications, has announced that it is further expanding its presence in South America. Production has now started at the new Gerresheimer Anápolis plant in Brazil's Goiás state.

The plant is initially operating over 3,200 m² of space and will be equipped with 30 machines during the course of 2018. Plans are to extend it to 20,000 m² by 2021. By then, it will produce the company's entire range of PP, PE and PET containers, plus related closures and caps, which will also be assembled and decorated there.

Gerresheimer has been active in Brazil since 2008, when it acquired Allplas. Vedat was added three years later. It claims to be Brazil's market leader in pharmaceutical plastic packaging.

› **www.gerresheimer.com**

Brand new, process-focused and free-to-attend, AMI's first Compounding World Expo and Plastics Recycling World Exhibition take place in Essen, Germany, on 27-28 of June 2018. We preview what's in store for visitors

Essen set to welcome new plastics events

Two new free-to-attend plastics exhibitions emerge on the European polymer events scene this month. Organised by *Injection World* publisher AMI, the Compounding World Forum and the Plastics Recycling World Exhibition take place in adjacent halls at Messe Essen in Germany on 27-28 June and both combine a tightly-focused exhibition with high quality free conference streams. Together, the two shows bring together more than 180 exhibitors and in excess of 2,500 visitors have already registered to attend.

While the focus of the shows is on compounding and recycling, there will be plenty going on at each to satisfy extrusion processors and injection moulders looking to find out more about the latest developments in additives, compounds and masterbatches or how to improve the sustainability of their processing or products.

Exhibitors include some of the biggest names in plastics such as BASF, Borealis, Coperion, Dow, Evonik, ExxonMobil, Fraunhofer, Imerys, KraussMaffei Berstorff, Maag, Merck, Mitsui, Motan Colortronic, NGR, Nordson, Omya, Solvay, Starlinger, Veolia, Wacker, and many more.

Compounds and additives

The Compounding World Expo features three free-to-attend debates covering key issues impacting on the technical compounds, masterbatch and PVC markets. Participants in the technical compounds debate include A. Schulman Senior Vice President and General Manager EMEA Heinrich Lingnau, Albis Plastic Vice President Technical Compounds Bernd Sparenberg, Ensinger Head of Compounding Dr Oliver Frey, and Kingfa Sci & Tech Europe General Manager Dr Christof Krogmann.

The masterbatch outlook will be explored by Ampacet Corporation President & CEO Yves

Main image: The German city of Essen hosts two brand new free-to-attend European plastics events in June - The Compounding World Expo and Plastics Recycling World Exhibition

Trends in the technical compounds business will be debated at the Compounding World Expo by (from left to right) A. Schulman Senior Vice President and General Manager EMEA Heinrich Lingnau, Albis Plastic Vice President Technical Compounds Bernd Sparenberg, Ensinger Head of Compounding Dr Oliver Frey, and Kingfa Sci & Tech Europe General Manager Dr Christof Krogmann

Carette, Clariant International Head of Region EMEA Norbert Merklein, Lifocolor Farben Managing Director Dr Martin Fabian, and PolyOne Corporation Global Marketing Director Color Additives and Inks Gary Fielding. Developments in PVC compounding will be discussed by KemOne Director of Marketing & Sales Yves Heroes, Automotive Compounding Industry/Perplastic Group General Manager Fernando Amaral, and EPPA Managing Director Gerald Feigenbutz.

Training and skills development will also be a key theme of the Compounding World Expo conference programme. For example, Dr Anna Gergely, Director for EHS Regulatory at the international law firm Steptoe & Johnson, will explain the process of compliance with the EU's REACH regulations. And Dennis Keller, PolyOne's European Head of Colour Marketing, will explore the psychology of colour and its importance in buying decisions.

The Compounding World Expo conference programme also features presentations detailing the latest developments in polymers, additives and compounds. These will examine topics such as electrically and thermally conductive compounds; flame retardants; compatibilisation; friction modification; nanocomposites; cross-linking agents; functional fillers; thermoplastic elastomers; and high-temperature polyamides. These insights will be delivered by technical experts from companies including Borealis, Europiren, Falcone, Georg H. Luh, HPF, Interface Polymers, Polyscope, Unipetrol, and Ziegler.

Recycling innovations

The Plastics Recycling World Exhibition also features a high-value, free-to-attend conference programme, again including several high level debates. These include a discussion of the future legislative landscape of recycling within the EU's Circular Economy between Steptoe & Johnson's Anna Gergely, RPC-BPI Group External Affairs Director Mike Baxter, Müller-Guttenbrunn Group Public Affairs and E-Waste Manager Chris Slijkhuis, and Nextek Managing Director Edward Kosior.

The future of End-of-Life Vehicle (ELV) recycling will be explored by WIPAG Deutschland General Manager Peter Weidemann, Fraunhofer ICT Department for Polymer Engineering Deputy Director Jan Diemert, and Veolia's Van Scherpenzeel Group Managing Director Roger Beuting. Packaging recycling issues will be discussed by Sloop Consulting Managing Director Graham Houlder, Ghent University Professor Kim Ragaert, and Suez Director Business Innovation Recycling and Recovery Christine Levêque. And development of Waste Electrical and Electronic Equipment (WEEE) recycling will be explored by Galloo Plastics Marketing Director Jannick Sercu, Fraunhofer IVV Business Field Manager Recycling and Environment Martin Schlummer, Axion Polymers Business Development Director Keith Freegard, and CoolRec Manager Plastics Tessa Slagter.

Building contacts

The organisers of the Compounding World Expo and Plastics Recycling World Exhibition have included two informal networking opportunities into the event. Football fans will appreciate the screening of the World Cup match between Germany and Korea in one of the conference theatres from 16:00 on the first day. And this will be followed by a networking party for visitors and exhibitors in Messe Essen's beer garden.

Compounding WORLD EXPO 2018

Plastics Recycling WORLD EXHIBITION 2018

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To find out more about the Plastics Recycling World Expo and review the full conference programme click **HERE**. Please register and download your entry badge in advance **HERE**.

From HP's Multi Jet Fusion printers to the STEP technology that Stratasys says can match injection moulding costs and volumes, 3D printing is making waves in plastics production. By Peter Mapleston

3D printing breakthroughs show production promise

3D printing (3DP) is catching on quickly around the world, with options in equipment and materials increasing at an astounding pace.

According to the **Wohlers Report**, which is generally considered the data bible on such things, average annual growth over the last seven years has been over 28%. The technology – or rather technologies, since there are many ways to print three dimensional parts – is expanding out of its niche as a prototyping tool and into production of functional parts. In 2016, final parts production made up over 60% of the 3DP market, according to Wohlers. In the future, 3DP will also be used for production of parts that require much higher mechanical properties.

In May, the umbrella association for plastics converters in Europe, **EuPC**, published a Vision Paper on 3DP and how it will shape the future of the plastics converting industry. 3DP can be done with a vast number of different materials (plastics, metals, glass, even food), but plastics are by far the most important material. In 2016, over 84% of materials sold for 3DP were polymers (according to Wohlers). "3DP offers huge possibilities and should be embraced as an opportunity to grow the business of plastics converters in Europe," says EuPC.

EuPC identified four general focus areas: medical technology (including Implants, single-use operation aids, and treatment fixtures); maintenance and repair of machines and installations (spare parts, in-situ printing for temporarily solutions, etc); personalised consumer products; industrial fixtures and attachments for equipment such as robot arm grippers.

In theory, any product that can be made by injection moulding, blow moulding, extrusion or thermal forming can be 3D printed. The relevant questions to assess the use of 3DP, EuPC says, are:

1. Can 3DP offer advantages in comparison to other converting processes, e.g. improve the functionality of the part or faster/cheaper production?
2. Are the functional properties identical or at least acceptable for the application?
3. Are the aesthetical properties identical or at least acceptable for the application?
4. Is it economically feasible?
5. Is it logistically feasible?

"At this moment, 3DP technology should not be seen as a threat to the majority of plastics converters," says EuPC. "In some specific areas, there will be some substitutions but in series production of substantial volumes there is still low economic feasibility. 3DP generally provides chances to cover

Main image: HP is working with more than 50 companies on its Open Materials Platform

Above: HP Jet Fusion 4210 in a production setting

the gap between single part production and high-volume production. However, the developments go very fast."

A widespread reservation about 3DP is the belief that it is not suited for final parts production, due to the material properties of 3DP parts or poor surface finishing, EuPC notes. "Development and improvements in 3DP processes are however progressing fast.

"The biggest barrier to the use of 3DP in the plastics converting industry probably are the high costs of machines and materials, but this is presumed to change soon. The rise of the economies of scale effect will make 3DP applications cheaper. The same applies for 3DP materials, especially as global companies have started to develop 3DP materials."

Multi Jet Fusion bows in

One of the most interesting new 3DP technologies to appear in recent months comes from one of the top players in 2D printing, **HP**. The company says that it has taken less than a year for it to become the leading provider of production-grade plastics 3D printers with its Multi Jet Fusion technology.

"Our 3D printing platform is unique in its ability to address over 340 million voxels [the 3D equivalent of a pixel in 2D photos] per second, versus one point at a time, giving our prototyping and manufacturing partners radically faster build speeds, functional parts and breakthrough economics," says Stephen Nigro, president of HP's 3D printing business.

HP opened its offering with two printers. The Jet Fusion 3D 3200 is said to be ideal for prototyping, while the Jet Fusion 3D 4200 is intended for prototyping and short-run manufacturing needs.

Pricing for the HP Jet Fusion 3D 3200 Printer starts at $130,000. HP says that, based on internal testing and simulation, HP Jet Fusion 3D printing solution average printing time is up to 10 times faster than FDM (fused deposition modelling) and SLS (selective laser sintering) technologies priced between $100,000 and $300,000 (as of April 2016). Average printing cost-per-part is half the cost of comparable FDM and SLS printer solutions, said HP.

This February, the company announced the lower-priced 300/500 series, which starts at between $50,000 and $60,000. They go on sale in the second half of this year.

At the Additive Manufacturing Users Group (AMUG) conference in St. Louis, US, in April, Nigro said that in the previous year, more than three million parts were produced on Multi Jet Fusion and more than 50% were for end use. The company is one of its own biggest customers: half of the plastics parts inside the Jet Fusion 4200, and over 140 parts inside the new Jet Fusion 300/500 Series, can be produced using Multi Jet Fusion technology.

HP says a key innovation in its technology is a high-speed, synchronous architecture for building parts layer by layer. Dual carriages scan across the working area in perpendicular directions: one carriage recoats the working area with fresh material, and the other prints HP functional agents and fuses the printed areas.

The entire surface is then heated by an infrared lamp. Only the fusing agent absorbs the heat and transmits it to the powder particles. These fuse into the prescribed structure while the surrounding material remains unaffected.

The vision for HP Multi Jet Fusion technology is to create parts with controllably variable–even quite different– mechanical and physical properties within and across a single part or among separate parts printed simultaneously in the build unit. This is accomplished by the use of "transforming agents" to control the interaction of the fusing and detailing agents with each other and with the material to be fused. "Depositing transforming agents voxel-by-voxel across each layer allows HP Jet Fusion 3D printers to produce parts that cannot be made by other methods," the company says.

Properties that HP transforming agents could control within and across a part include dimensional accuracy and detail; surface roughness, texture, and friction coefficient; tensile strength, flexibility, hardness; electrical and thermal

Right: Components manufactured with HP's 3D printing Multi Jet Fusion technology

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conductivity; opacity; and colour. This means that, for example, a part can have durable, hard surfaces with a low friction coefficient where contact and wear will occur, and different properties elsewhere to meet other functional requirements.

HP says it is growing its portfolio of HP-branded powders, while its open platform model encourages third-party collaboration and materials expansion. "HP plans to continue expanding the palette of material offerings even further – delivering a wider family of thermoplastics, including those with flame-retardant properties," a representative says. "And we're exploring new materials, such as elastomers, polyamides, commodity plastics, and high-performance materials."

New polyamides

Evonik is a participant in HP's open platform program. It is currently expanding its production capacities for PA powders used in Multi Jet Fusion and various sintering processes. A new production line in Marl, Germany, which went on stream early this year, increased capacity for Vestosint powders by 50%.

The company says it is among the leading global

Left: Air duct component for an engine compartment 3D printed in Evonik's Vestosint PA powder

suppliers of sintering powders for 3DP (it also offers PEEK powder for extra-high-temperature applications). Sylvia Monsheimer, Director New 3D Printing Technologies, Evonik Resource Efficiency, says powder-based methods now established on the market (apart from HP's) include not only the well-known SLS, in which a laser produces the component, but also selective heat sintering (SHS), which uses a thermal printhead instead of the laser. "A relatively new technique is high-speed sintering [HSS], in which the powder is printed with an

Right: Design study in a laser-sintered material from EOS

energy-absorbing ink and heated by infrared radiation," Monsheimer says. (HSS was invented at Loughborough University in the UK.)

Evonik is also investigating the potential of other polyamides for 3DP. It cites PA613, whose relatively high fusion point ensures particularly good heat resistance; in addition, the material has excellent rigidity combined with optimal elongation at break. "As a result, products made from PA613 are extremely strong but not brittle," says Monsheimer. PA613 has already been successfully tested in motor sport: a ventilation duct with an integrated heat shield in a Lotus racing car withstood several races with no problem.

Fastest SLS

Other companies active in sintering technologies have been introducing developments aimed at high-speed production. For example, late last year, **EOS** introduced its EOS P 500 system, which it says "offers high efficiency for lowest cost-per-part, comes automation ready and can process polymer materials, which require operating temperatures of up to 300°C". The EOS P 500 builds twice as quickly as the current fastest laser sintering machine (EOS P 396) thanks to a dual-laser system fusing the powder, and a new recoater, which applies a new layer of powder to the building platform with high speed (600mm/s) and maximum adjustability.

The new unit can handle such polymers as PA6, PBT, PET, PPS, PEKK and others. The first high performance polymer available is based on Arkema's Kepstan PEKK. EOS says it also cooperates with Evonik and BASF for developing future polymer materials.

Below: BASF's Photo-Resin X004M is suitable for break-resistant parts such as these (post-coloured) electric circuit connectors

EOS has also begun European distribution of three high-performance polymers from its subsidiary ALM, which focuses on providing customised material solutions for the additive manufacturing market. These are a two PA 11 grades, one carbon fibre reinforced and one flame retardant; and a PA12 containing hollow glass microspheres and carbon fibres.

3D Systems, meanwhile, was at Rapid+TCT 2018 in Fort Worth, US, in April to show off its Figure 4 platform, which is says is the fastest, most accurate 3DP technology available (it uses a light-based UV curing process), as well as, for larger parts, the ProX SLS 6100. EOS says the ProX SLS 6100 "enables customers to seamlessly scale from functional prototyping to low volume functional production parts." 3D Systems offers a portfolio of polyamides for the printer, which includes six grades based on PA 11 and 12.

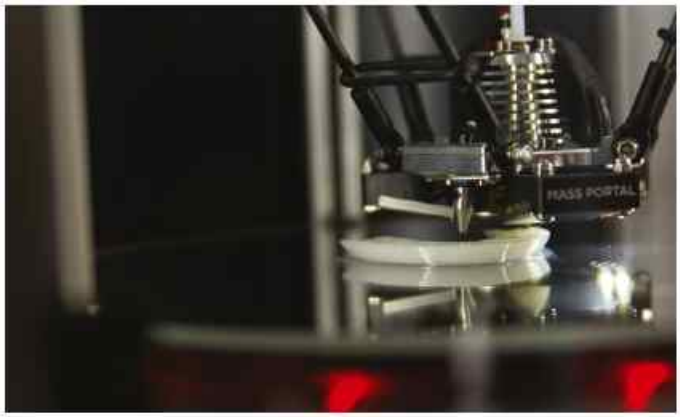
Lots more materials

Many materials suppliers are upping their 3DP game, with numerous products debuting at events such as the AMUG Conference, Rapid+TCT, Formnext (in Frankfurt, Germany), and of course NPE2018 in Orlando in May. A lot of the buzz is in materials for fused filament fabrication (FFF), but several polymer suppliers are approaching the market on several fronts.

One of them is **BASF**, which last September set up BASF 3D Printing Solutions. It presented a variety of new filaments branded Ultrafuse at AMUG. Together with Texas-based **Essentium Materials**, it is also building up a global distribution network for plastic filaments.

New products include Ultrafuse Z, described as an extra strong filament based on BASF materials, further developed by Essentium, and offered in combination with Essentium Materials' processing technology, FlashFuse. Firat Hizal, Marketing & Sales Manager Plastic Filaments at BASF 3D Printing Solutions, says optimum strength in the z-direction is possible. The partners intend to launch filled and flame-retardant filaments later this year.

BASF says Ultrasint PA6 LM X085, based on PA6, provides a new alternative for PA11 and 12 powders for use in SLS processes. The grey powder melts at about 193°C and is said to be easy to process on most commonly used SLS machines. BASF is targeting customers in automotive and consumer goods in particular. ›



DSM recently announced a partnership with 3Dmouthguard to develop custom-made 3D-printed (FFF) Arnitel TPE mouthguards for sports. "By scanning the upper jaw with video technology and digitally capturing all curves and shapes of mouth and teeth, a perfectly fitted mouthguard can be printed on the spot using fused filament technology," says DSM, adding that the bio-based TPE meets all strength, flexibility and health requirements. "3D printed mouthguard machines could soon be a must-have in every sports facility around the world," says Arno Hermans, CEO of 3Dmouthguard, which is also looking to expand into other personalised protective sports items. Photos show a mouthguard being printed

Alexander Cochrane, Marketing Manager 3D-Printing Powder Bed Fusion, says manufactured components are very stiff and strong. "We expect to be able to supply our first customers with our powder material in late summer," he says.

BASF 3D Printing Solutions is also working on various new developments in the field of UV-reactive materials. Photo-Resin X004M, which recently became available, has been specially optimised for stereolithography (SLA), digital light processing (DLP) and LCD printers. The supplier says the new material has high tensile strength and high elasticity modulus.

"We also plan to bring our latest material developments in the area of photopolymers to the market in the near future, to meet industry customers' requirements for flexible and above all high strength photopolymer components," says András Marton, Marketing & Sales Manager Photopolymers.

DSM is also taking a multi-pronged approach to 3DP. Last November, it aligned all activities within a new integrated business, DSM Additive Manufacturing. The company has been a major player in SLA for over two decades, with its Somos materials. The new business will also offer FFF materials as well as experience from years of research in other processes. It will initially focus on four market segments in particular: healthcare, transportation, sport and lifestyle, and tools and electronics.

Hugo da Silva, VP of Additive Manufacturing (AM) at DSM, says: "Right now, there is a lot of excitement around FFF and DSM has a growing portfolio of materials for this technology, including Novamid polyamide and Arnitel thermoplastic elastomer. But we intend to go much further [with] new solutions for SLS, Multi Jet Fusion, Ink Jet and Binder Jet. We also want to explore new and emerging technologies in AM as they graduate from research."

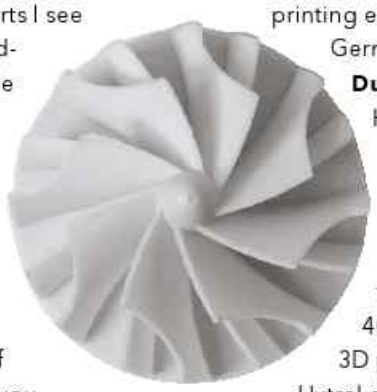
Latest FFF introductions include Arnitel ID 2060-HT thermoplastic polyester elastomer, which DSM says is the first material for FFF that can be used for applications that require long-term high temperature conditions such as auto air/fuel management systems.

Also new is Novamid ID1030-CF10, a copolymer of PA 6 and PA 66 containing 10% carbon fibre. DSM says it was created to answer unmet demands from the 3D printing community for a high-performance material with very good strength and stiffness. "This material can create parts with properties much closer to what is normally only achievable by injection moulding with carbon fibre-reinforced compounds," says Scott Nordlund, Sales Director, Additive Manufacturing North America. "The carbon fibre loading, at 10%, is lower than in many IM compounds, but we have tuned the formulation to work within the boundaries of what is processable on 3D printers. Users will be able to run their printers at the same speeds as with unreinforced plastics, but they will get considerably better strength. Toughness is also very good."

There is still quite a long way to go before additive manufacturing succeeds on a large scale in production of finished parts, cautions Patrick Duis, Segment Leader Transportation. Printing technologies are getting faster and machines are getting bigger, he notes, but they still need to better demonstrate their long-term reliability and repeatability. That said, the last three or four years have seen major improvements in the quality of parts that can be made on FFF printers, he points out. ›

There is also the question of designing for 3D printing. "There is a paradigm shift going on here," says Nordlund. "Engineers are still trying to understand how to best utilise the free-form design characteristics of 3D printing."

Duis agrees. "In the automotive applications I am working on, nine out of ten parts I see were designed for injection moulding. It's really difficult to get people to think for 3D printing. We are still in a transitional phase."



Right: 3D4Makers part in Perstorp's Facilan C8 material

3D printing obviously permits personalisation, but Duis also points out that it is very well suited to car makers who produce in small volumes, who may struggle to justify the costs of injection moulding tooling. "So if you can use a PA6 in 3D printing to produce parts that perform like injection mouldings, then you can start using the technology in real life. I already see today that a lot of desktop printers are being considered by numerous OEMs, now that performance and reliability is improving."

At Rapid+TCT 2018, DSM announced a partnership with equipment manufacturer **Ultimaker** to meet the growing demand for industrial-grade engineering FFF materials. It says customers will be able to print automatically with DSM materials using preconfigured settings available in Ultimaker Cura.

Several material makers are moving closer to 3D printing equipment makers. At Fakuma in Germany last October for example, **DuPont** announced that filaments in its Hytrel thermoplastic elastomers and Zytel polyamides for use across the EMEA region can be acquired through German RepRap.

Hytrel filaments are available in two different hardness levels (Shore D 40 and 60). Mechanical properties of 3D printed parts in all directions using Hytrel grades are comparable to injection moulding, DuPont claims. With Zytel 3D1000FL, customers will be able to make strong and stiff functional parts.

"With these new high-performance 3D filaments open for all printers and the know-how of industrial 3D printing of German RepRap, fused filament fabrication makes a step forward to become a

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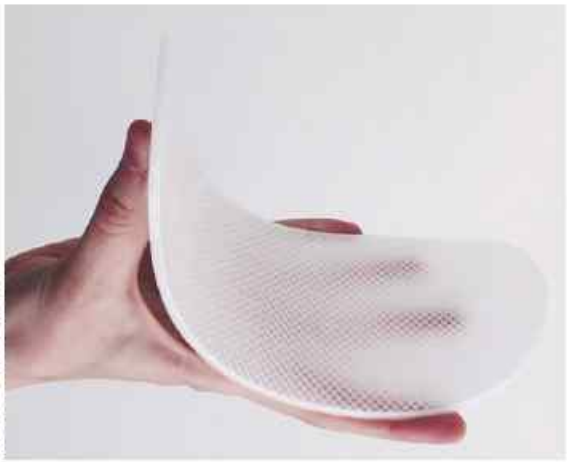


PHOTO: VERA DE PONT

Left: Insole in Perstorp's Facilan PCL 100

credible manufacturing option for functional components," says Ernst Poppe, New Business Development manager EMEA, DuPont.

Bespoke polymers

Speciality chemicals company **Perstorp** recently formed a joint venture called ElogioAM with **3D4Makers**, a high-performance 3D printing filament producer. "ElogioAM is bringing the world's first fifth-generation 3D filament, Facilan, which enables applications previously unobtainable with other 3D printing materials," Perstorp says.

ElogioAM will target applications in medical, fashion, orthotics, advanced prototyping, modelling, and demanding industry and consumer markets. "Facilan filaments have been designed to outperform," says Perstorp. "Facilan C8 3D printed parts, for example, have higher impact and tensile strength than ABS filaments while being based on compostable raw materials. Facilan C8 parts have a soft touch feel and are smoother than PLA parts."

The partners are not disclosing the composition of Facilan C8 composition while they await approvals for the JV, says Joris Peels at 3D4Makers. He also explains what is meant by "fifth generation."

"The first generation of materials was 'whatever worked' – a wax for FDM or the only resin that gave a coherent result for SLA, for example. The second generation was of the 'looking good' materials; functionality was not important and sorely lacking. The third generation was the 'semi-functional materials' such as ABS, polypropylene and the like – familiar but not yet optimised for 3DP. This third generation is where the majority of our industry is functioning at currently. With the fourth generation, we have 'real life' materials [which] can be used in very demanding applications; we're entering an era of qualification, certification, flammability testing, compliance.

"With the fifth generation of materials, we're not just trying to make a pre-existing polymer work in a high-volume application – the material itself has been created specifically for 3D printing. We're looking at what is actually possible with 3D printing. We're looking from the monomer to the polymer to the filament to the part.

"In sixth generation materials, we'll be seeing more awareness by design and engineering departments with what 3D printing can do. We can expect designers and engineers to go beyond the shape of things to designing a particular part to perform in novel ways."

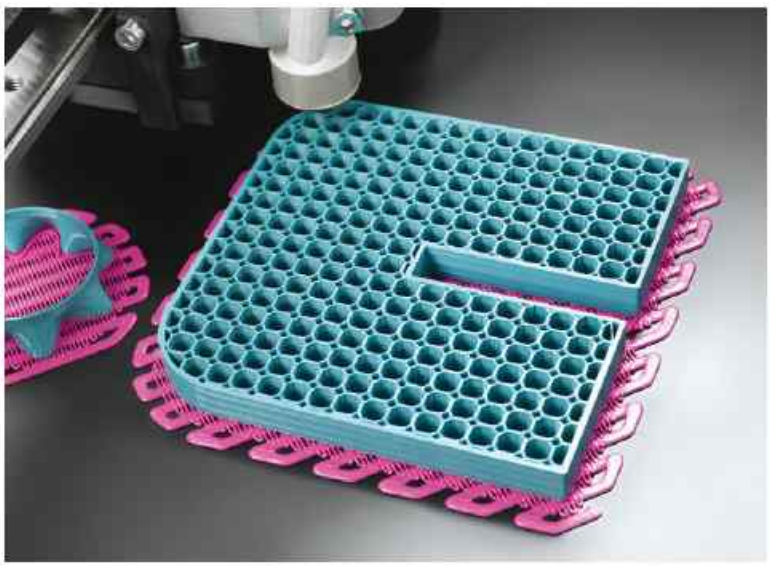
Facilan PCL 100 is a pure polycaprolactone filament that is being used by researchers in artificial muscles, drug loaded implants, scaffolds and smart materials.

Clariant is best known in the plastics industry for additives such as flame retardants, pigments and waxes, as well as for its extensive masterbatch portfolio. But for 3D printing, it is taking a different approach. In December, it unveiled a dedicated 3D Printing business that will supply "premium and customised" 3D printer filaments. It says the new business leverages its long experience in tailoring polymers for a broad range of end market applications with pigments, additives and masterbatches.

"Extensive material, application and production expertise allows Clariant to work closely with customers on polymer, additive and colorant selection to address typical end-use conditions such as weathering (sunlight, UV exposure), flame retardancy and electrical properties," the company says. Materials are available in flexible lot sizes to meet the specific needs of customers.

"At Clariant we have all the capabilities to produce high-grade ready-to-print 3D printer filaments," says Richard Haldimann, Head of New Business Development of Clariant.Clariant can deliver tailored solutions from a global base, he says. ›

Below: 3D printed Clariant logo



Above: The H2000 Infinite Build system from Stratasys uses an extruder processing mini-granules

At NPE, **SABIC** launched three new filaments for FDM: Ultem AM1010F filament for general high-temperature applications, including tooling; and Ultem AMHU1010F and Lexan AMHC620F filaments for healthcare applications.

Ultem AM1010F, a polyetherimide, provides high heat resistance (a glass transition temperature of 217°C) and high mechanical strength. It can be used in applications such as short-cycle injection moulding tools, carbon-fibre layup tools, and automotive components. The filament is UL94 V-0 compliant at 1.5 mm and 5VA compliant at 3.0 mm.

Ultem AMHU1010F and Lexan AMHC620F filaments are made with SABIC healthcare-grade resins. SABIC says new healthcare application development can become more efficient by using these filaments in prototypes, as the same base resin materials are available in injection moulding grades for production.

In April, **Solvay** said it was aiming to take additive manufacturing to the next level with the launch of three specialty polymer filaments "that promise to introduce game-changing performance for 3D-printed parts." Based on the company's KetaSpire PEEK and Radel PPSU polymers, they are the first products in what Solvay plans to become a broader portfolio of specialty polymer filaments and powders designed specifically for high-end AM applications.

Solvay now offers a neat PEEK product and a 10% carbon fibre-reinforced grade of filament. Both are designed to allow excellent fusion of printed layers, enable high part density and deliver exceptional part strength – including in the z-axis. The PPSU filament is also formulated to allow excellent fusion of layers, and also offers high transparency, excellent elongation and superior toughness. Solvay is also developing an 3DP-ready powder based on its NovaSpire polyetherketoneketone (PEKK) polymer, which will target applications in aerospace and healthcare.

Away from 3DP with filaments, **Carbon** announced two new materials for its Digital Light Synthesis process a few weeks ago (see IW June 2017 for details on the process). These are epoxy EPX 82 and elastomeric polyurethane EPU 41. EPX 82 is a high-resolution and high-strength engineering material with excellent long-term durability, while EPU 41 is the company's production-scale elastomeric material offering higher resilience for making durable, elastic lattices.

EPX 82 is a high-strength engineering material with a heat-deflection temperature of 125°C and good impact strength, making it ideal for applications requiring a balance of strength, toughness, and thermal-cycling durability such as connectors, brackets, and housings in the automotive and industrial sectors. Its mechanical properties are comparable to lightly glass-filled thermoplastics like polyamides and PBT and meet the USCAR-2 fluid compatibility standards.

Aptiv (formerly Delphi) is using EPX 82 for the production of electrical connector housings. Jerry Rhinehart, the company's Manager of Additive Manufacturing Development, says the company's confidence in EPX 82 "enables our product development engineers to free their minds from the design constraints imposed by traditional manufacturing processes, paving the way for the

Q&A with Ramon Pastor, Vice President and General Manager, HP Multi Jet Fusion, HP

Injection World: Which plastics materials companies is HP working with?

Raman Pastor: We recently added Dressler and Lubrizol to a list of global industry leaders that includes Arkema, BASF, Evonik, Henkel, Lehmann & Voss, and Sinopec Yanshan Petrochemical Company. DSM and Dow Chemical are among the companies that have acquired our Materials Development Kit with the objective of developing new materials for Multi Jet Fusion in collaboration with HP. There are now more than 50 companies actively engaging on our Open Materials Platform.

IW: Do you have numbers on how many machines you have sold, how many companies are making production parts with them? ›

creation of connectors that outperform their injection-moulded counterparts by adding value through geometric complexity." EPX 82 and EPU 41 are currently available to Carbon customers in North America only.

Bigger, faster

Another pioneer in 3DP, **Stratasys**, is taking routes to both bigger and faster production in 3D printing. Its H2000 Infinite Build system, aimed principally at aerospace and automotive applications, is said to eliminate the barriers to the production of large custom parts or panels, manufacturing aids such as large trim and drill guides and holding fixtures, and development-level or small-run layup tooling.

Unlike other Stratasys FDM 3D printing systems, the H2000 does not work with filaments, but rather an extruder processing mini-granules. Also, unlike other FDM systems, which build up parts with a series of horizontal planes, the H2000 creates vertical planes on a table that moves sideways rather than up and down. "This allows unlimited part scalability in one dimension for very large, custom, multi-material tools and production parts," the company says.

The Hydra Robotic Composite 3D Demonstrator takes things a step further by putting both the build surface and the extruder on robotic arms to provide six axes of freedom. This goes a long way to overcoming problems with anisotropy inherent in FDM and FFF systems, where mechanical properties within layers (x-y direction) are higher than interlayer properties (z direction). Two systems have been installed with development partners. Both are very big, but Michael Anton, Materials Business Manager, EMEA, says future models could well be smaller, possibly even with desktop dimensions.

A third Stratasys development takes the group in a completely new direction – so much so that the business has been spun off into a new company. In

Polyamide producer Domo Engineering Plastics has collaborated with Ciceri de Mondel (an Italian plastics sheet producer that expanded into filaments a few years ago) to develop Thermec Zed filament for 3DP. It is already being used in the production of customised hulls for an innovative electric motorcycle producer. Domo says the material guarantees excellent adhesion between layers, prevents delamination and ensures minimal shrinkage during the printing process. "Up to 200°C, no known solvent affects it, and it is inherently flame retardant," it says.

RP: There's been a major acceleration in companies that are using Multi Jet Fusion for final parts production. Jet Fusion printers are now used for end-production over 50% of the time, and that number continues to grow significantly. One of the reasons behind that growth is that our customers have started placing repeat orders for HP 3D printers to fulfil a growing volume of large-scale 3D production orders. It's not just one or two units at a time, leading manufacturers around the world are purchasing as many as 12 or 18 Jet Fusion units in a single order to increase their 3D manufacturing capacity.

IW: What is the biggest part you can theoretically make?

RP: The build size for HP's Jet Fusion printers is 12 x 16 x 16 inches [305 x 406 x 406 mm], so any part fitting in this volume can be made. Larger conjoined parts can also be made whose components are within that size.

IW: What plans do you have to make printers for even bigger parts?

RP: Multi Jet Fusion technology is not physically limited and has a very scalable infrastructure, so larger printers will certainly be possible, but our current build size covers the vast majority of plastic parts and applications in the world.

IW: Does it in fact make sense to use your printers for big parts?

RP: In traditional manufacturing, the cost of a physical mould is commensurate with its size, so the bigger a part is the more expensive it is to produce. Multi Jet Fusion is most cost-effective for parts that fit within our build volume, which provides significant savings in fixed costs, but the competitive advantages go far beyond part size.

IW: Where would you say is the cut-off point between Multi Jet Fusion and injection moulding?

RP: For physical part size, within our build volume. For production volume, we doubled the economic break-even point for large-scale 3D production to 110,000 parts with the launch of our Jet Fusion 3D 4210 printing solution, which enables the 3D industry's lowest cost-per-part.

IW: I have seen one materials company you work with describe the technology as a form of advanced sintering. Is this a valid description?

RP: Unlike sintering, Multi Jet Fusion technology fully fuses plastics. This is one of our key differentiators, and the reason why our mechanical properties enable the 3D production of engineering-grade parts.

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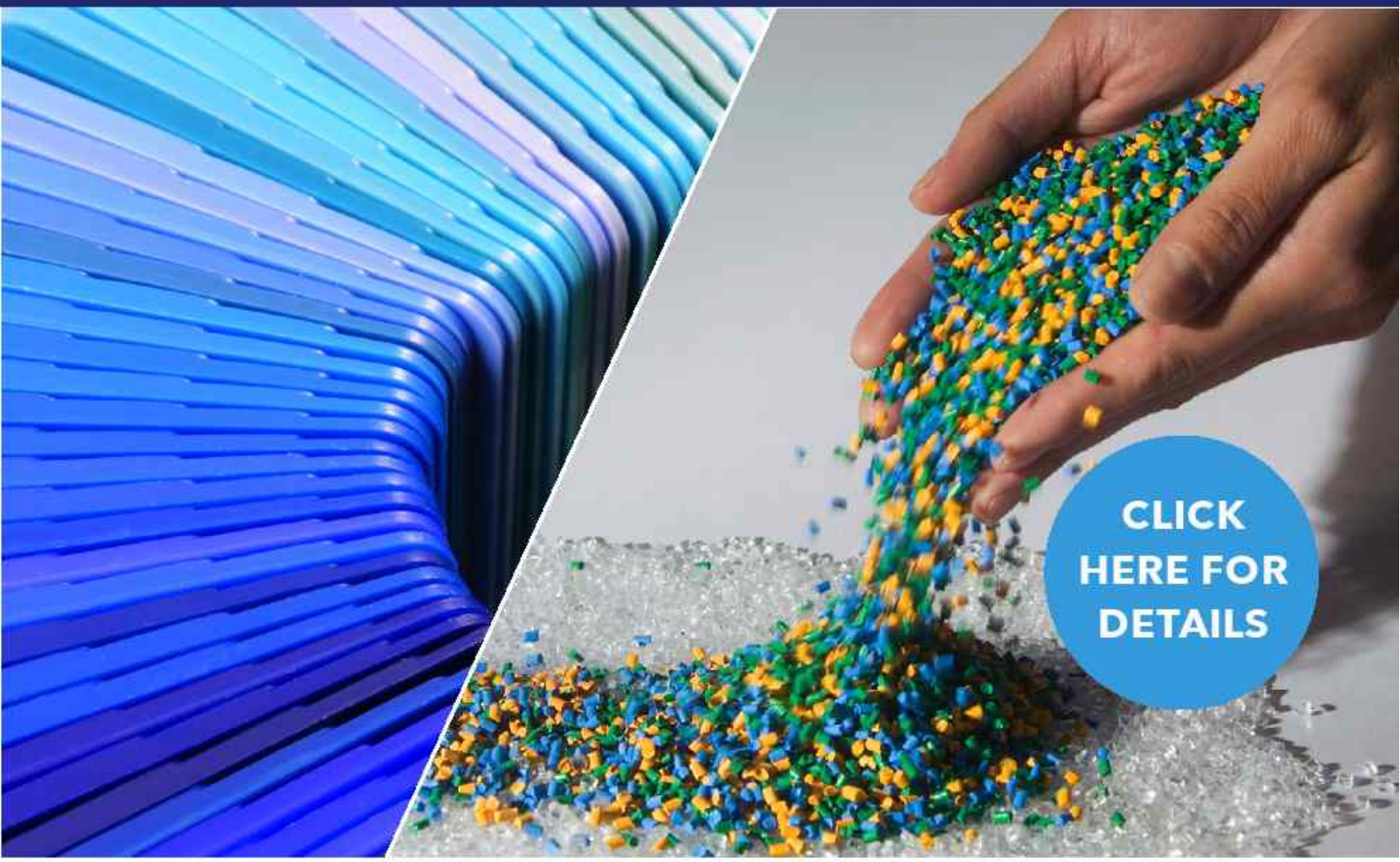

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April, it announced the formation of Evolve Additive Solutions to handle its Selective Electrophotographic Process (STEP) technology, which it has been incubating for the last 10 years.

The intention is to deliver high-volume production additive manufacturing "at breakthrough speeds compared to other commercially available additive processes," says the company, which is also pitching STEP against production processes. "The solution is intended for high-volume production runs into the hundreds of thousands per year. As such, it is expected to compete with traditional processes, such as injection moulding. The highly scalable and extensible solution combines Evolve's own proprietary technology with the proven capability of electrophotographic imaging."

"We believe the STEP technology is uniquely positioned to bridge the gap in the market not yet addressed by additive or traditional manufacturing technologies," says Steve Chillscyzn, CEO of Evolve Additive Solutions and co-inventor of STEP.

The STEP process is said to use sophisticated bonding techniques to create parts "that are fully dense with isotropic properties of injection moulding." It works with amorphous and semi-crystalline thermoplastics, with production speeds of up to 50 times faster than existing additive manufacturing solutions. Cost per part and surface quality are claimed to be comparable to traditional manufacturing. Different materials and colours can be combined within the same layer.

According to Stratasys, Evolve has already commenced seeking initial purchase orders from several leading automotive, consumer goods and aerospace companies during its alpha stage. "Over the next 12 months, Evolve also plans to engage new customers to evaluate beta systems for applications in volume production environments across many vertical markets," it says. Evolve has not yet announced the date of expected general availability of its products.

More materials for APF

Arburg says practical experience with its Arburg Plastic Freeforming (APF) technology "has clearly demonstrated that this open system is not only suitable for prototyping, but also and particularly for the industrial additive manufacturing of functional parts." The company points out that one big advantage of APF is that the qualified standard plastic granulates used in injection moulding can be processed.

The extent of setting options is comparable to those available with injection moulding, Arburg says. The better the process is adjusted, the higher the part quality. During testing of the strength of tensile rods made from PC (Makrolon 2805), the yield strength in the x/y direction corresponds 100% to that of injection moulded parts, while a very good value (83%) is also achieved in the z direction.

Above: Stratasys has set up Evolve Additive Solutions to handle its Selective Electrophotographic Process (STEP) technology

The material database for AFP continues to grow. In autumn 2017, semi-crystalline PP was added, followed this March by PMMA and SEBS, joining amorphous standard granulates such as ABS, PA, and PC. At the Freeformer User Day in April 2018, the APF team reported on new hardware and software features as well as providing tips on additive manufacturing using the open system. The new upgraded slicing software is available to all customers as a free update. The enhancements result in a high level of process stability and part quality.

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Appeal of IML and IMD grows widely

In-mould labelling and decoration are breaking out from their established packaging market, but other technologies are also making advances. Peter Mapleston reports

Go to any plastics show, and some of the most fascinating displays to watch are high-speed injection moulding of containers with automation systems for in-mould labelling (IML). There are sometimes so many of such production cells running that you might think all containers are decorated this way. That's far from the case, but growth in IML is high, and developments in equipment and materials are taking IML into new areas – application-wise and geographically – all the time.

However, IML is not having it all its own way: older technologies are fighting back, and there are some newer decoration methods on the block too. And of course, decoration is not only for packaging – there's plenty going on in other consumer-oriented products that benefit from a splash of colour.

Market research consultant **AWA**, which has been following the IML market for many years, says new applications are burgeoning in broader industrial markets for in-mould technology around the world. It recently published its latest market update report, *AWA Global In-mould Label Market Study 2017*, and will also publish reports on in-mould decoration and in-mould electronics later this year.

"With a very small share of the enormous global label market – at around 4% – in-mould labelling is just beginning to establish itself as a mainstream contributor, thanks to its significant advantages for brand owners," AWA says. "It delivers manufacturing economies and efficiencies without sacrificing the aesthetics of a product's packaging. By providing photo-quality printed graphics – often on highly-durable label materials – it performs exceptionally well on thin-walled plastics packaging.

"However, in-mould labelling is not an instant-access technology. Its adoption by an end-user requires considerable capital investment, and the market has the most complex structure and value chain configuration of any packaging decoration method, so there are resultant high barriers to entry at all levels."

Global IML markets

Europe is the most mature market for in-mould labels, with 59% of the global total, mostly in the injection-moulded format, and today the region exhibits wide acceptance of the process across a broad range of end-use segments, AWA notes. "In North America, the use of in-mould labels for promotional activities – at sports events, in cinemas,

Main image: Injection-compression moulded IML decorated lids (Pic: StackTeck)

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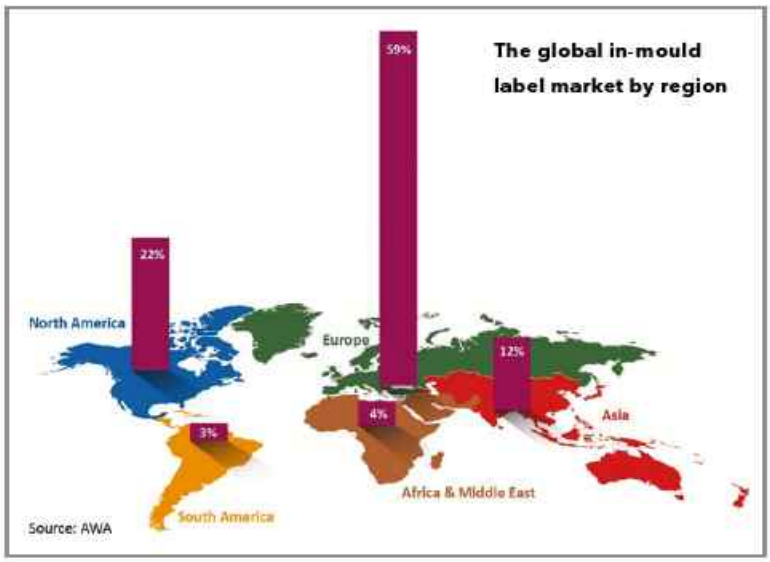
in fast-food outlets -- is a major feature. The development of high-quality lenticular and holographic label printing capabilities to enhance a label's visual attraction are a popular feature that pad printing and direct-to-container print cannot match.

"In Asia – generally considered the fastest-growing market across the label market – the lack of regional homogeneity and the complexity of the supply chain have so far restricted the speed of IML's acceptance in the emerging economies of China, India, and South East Asia, where the key on-the-go beverage markets are highly competitive."

However, in Japan, IML enjoys an established market in the health and personal care product segments, with some 30% share of the country's total IML usage. China offers the greatest growth potential, but IML is currently limited to certain market segments like lubricants, which AWA research indicates represent an estimated 60% of China's IML usage. Across the region, the injection moulding format dominates.

AWA says IML is currently experiencing competition from direct-to-container print. Pad printing is an established and popular process in many markets. However, AWA says, the main and growing competition to IML comes largely from today's advanced digital inkjet presses, which certainly deliver the high-quality graphics that brand owners expect, and also offer some unique, and much-prized, advantages such as mass personalisation and limited editioning. "Direct-to-container digital inkjet print certainly constitutes a paradigm shift, and it may represent 3% to 5% of product decoration in the next ten years -- or an even greater market share," the consultant says.

The in-mould production process involving a printed image is expanding into fields other than labelling that are exhibiting lively growth, AWA goes on. Again, a paradigm shift in its breadth of



applications, it says. It envisages more complete product decoration, which might also deliver brand owners' interactive customer communication devices, such as augmented reality options, as well as sensors and even printed electronics using conductive inks.

Viappiani Printing, a major supplier of IML labels, has been involved in a cooperative project, presented at NPE2018 in Orlando in May, to develop large coffee capsules for the US market (Keurig K-Cups) that are injection moulded in biodegradable PLA and also decorated with PLA labels. Talking to *Injection World* at Plast 2018 in Rho, Italy, in May, Matjaž Gorjup, the company's General Manager, says that PLA is a difficult material to print. "It is also not so easy to cut," he says. But the company has nevertheless managed to obtain high quality labels. "We are very proud of what we have achieved. This is a small part and we are working with a difficult material."

If the technology succeeds, it could prove to be a key moment in the development of the coffee capsule. As moves towards the circular economy continue, and the EU in particular takes a closer look at single-use packaging, the concept of wholly compostable coffee capsules – no difficult combinations of organic waste, aluminium and non-biodegradable plastics – is likely to become increasingly interesting. Every day, tens of millions of coffee capsules are used around the world and only a tiny proportion are recycled (virtually none are composted, although at least one European coffee maker uses Mater-Bi from Novamont for some of its capsules).

At NPE, the process was running on a Netstal injection moulding machine running with a mould from Fostag and automation from Beck Automation. PLA labels from Verstraete IML were also used. The

Left: PLA coffee capsule with PLA label pictured at Viappiani Printing's Plast 2018 stand

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Decorative labels applied in-mould to soup containers made by ITC Packaging for Spanish organic food producer Dulcesol also provide an oxygen barrier that enables Dulcesol to do away with preservatives. The labels help create containers with an oxygen transmission rate 100 times less than packaging with a standard IML label. The labels also withstand pasteurisation. Verstraete IML utilised a combination of specific inks, a special lacquer, and a special pasteurisation-resistant oxygen barrier film

production demonstration at NPE was carried out on a four-cavity "proof of concept" mould. A full production mould with more cavities should be ready in August.

Viappiani is also involved in a second project for labelling regular (smaller) capsules, where once again PLA is being evaluated. (Last October, Beck, Fostag and Netstal demonstrated production of coffee capsules with a pre-metallized wrap-around IML label from Verstraete IML. That was also on a four-cavity system.)

The project with Beck and Fostag is a sign that Viappiani is now expanding beyond its home market in Europe. Gorjup says the company is also growing business elsewhere. In fact, Viappiani – which is owned by the Austrian CTI Group, which specialises in printing and has affiliates in Europe and in several South American countries – has plans to expand its IML activities worldwide. "We want to follow the big brands," he says.

Gorjup reckons there are fewer than ten companies globally that are dedicated like Viappiani is to IML. "It requires a lot of dedication," he says. "Technical support to customers is particularly important, as is quality consistency of course." This year, the company is investing over €6m in new printing and cutting equipment and in strengthening its laboratory operations.

Wider acceptance

Verstraete IML had its products running on no fewer than 11 injection moulding systems at NPE, demonstrating the ability of IML not only to decorate but also to provide interesting surfaces and improve barrier. "We see IML making more and more inroads into the market, as brands find an increasing need to differentiate their products," says Sales & Marketing Manager Dieter Maes.

Verstraete IML is now a Multi-Color Corp company. MCC, headquartered in Batavia, Ohio, is another international label maker, with more than 70 facilities around the world. This June, Verstraete IML opened a new IML manufacturing facility close to the MCC headquarters.

IML started in Europe a long time ago, and the US is still playing catch-up. "All our major customers in Europe have established a local presence in the US, with local project management and technicians for maintenance," says Maes. He cites the acquisition of CBW Automation (based in Fort Collins) by Mold & Robotics Group, which already owned Swiss IML automation and tooling company H. Müller-Fabrique de Moules. Another IML specialist, French mould maker Plastisud, has had a presence in the region for several years, through its acquisition of Integrity Mold & Die (now Plastisud USA) in Mt. Vernon, Kentucky. "The locals have been growing their knowledge too," Maes says.

"IML is now standard in the USA in many major categories of packaging, whether they be ice-cream, margarines, spreads, salads…" he notes. "Containers for products like confectionery and paints will follow, just like they did in Europe."

Barrier is an important growth area for IML in thin-wall packaging, Maes says. These types of labels are generally made from coextruded PP film with an EVOH core. "It's not going to enable this type of packaging to replace glass or metal, but many food companies are looking to enhance product characteristics without the need for preservatives, and it can help here," he says. "This is a sweet spot where we have been putting in a lot of development effort." ›

Left: Decorative brush effect, printed with Norilux DC on a PC film. Second surface decoration was printed with another Proell ink system for IMD, Noriphan HTR N the IMD/FIM ink system Noriphan HTR N

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Also emphasizing IML at NPE was **StackTeck Systems**, based in Brampton, Canada, which specialises in multi-cavity, high-volume production moulds for thin-wall packaging, closures, medical, and mould bases. The system was running at the booth of Ilsemann Automation, labelling lids produced on StackTeck's first injection-compression mould in an Arburg machine. Once again, it had four cavities. The labels came from Verstraete IML.

"This injection compression lid mould has been built to demonstrate light-weighting potential for a known thin-wall IML lid," says StackTeck. "Compared to the conventional injection moulding process, the lid panel thickness was 37% thinner, resulting in a part weight reduction from 6.35 g to 4.67 g (26% lighter)."

IMD applications

IML can be seen as a sub-set of in-mould decoration (IMD), which embraces various ways of putting films onto packaging and non-packaging products in the mould, using not only pre-cut films but also reel-fed film. But coating specialist **Leonhard Kurz** says that IMD with multi-cavity moulds using reel-fed material has historically been applicable only to the processing of continuous designs or the manufacture of small, flat components.

"Complex shaped or larger sized plastic parts requiring an entire IMD foil web width to decorate could only be provided with single image designs in a single cavity," the company says. But that may be about to change. Kurz has just unveiled a patent-pending IMD foil feeding unit that can be used for single-image decoration of these kinds of components in a twin-cavity mould.

The IMD SI Duo device, which is integrated into the injection moulding machine, controls the feeding of two independently positionable foil webs in a double or multi-cavity mould. It allows two different IMD foil designs to be used, and single-image or continuous designs to be combined arbitrarily; furthermore, the cavities can have identical, mirrored or different geometries. High precision foil positioning is ensured in every case, even with different feed distances for the two foil tracks or with dissimilar plastic components.

The precise alignment of the single-image designs is achieved with sensors that read the registration marks on the IMD foils. Mounted on the outer sides of each of the two foil tracks are a pair of sensor blocks for the X and Y directions that enable a positioning accuracy of a few hundredths of a millimetre in both directions. For longer components, an additional sensor can be installed to ensure precise positioning in the Y direction.

Helmut Högl, Sales Engineer Special Application at Kurz, says: "The demand for positioned designs [for multi-cavity moulds] is growing rapidly. Not only single images, but also tactile surfaces, human machine interface and backlighting solutions require the designs to be transferred with a well-defined, very tight tolerance.

"The IMD SI Duo enables plastic components to be decorated with high efficiency and with extremely precise positioning of the design. With this foil feeding unit we are making the IMD process even more attractive and economical."

The device can be adapted to suit the structural and technical requirements of existing injection moulding machines or constructed to precisely fit into new machines. If required, it can be reconfigured from dual to single cavity decoration by centrally arranging one of the foil tracks. It was seen in action for the first time at the KraussMaffei Competence Forum in Munich in early June. Ten-inch HMI displays were IMD moulded in a twin-cavity mould on a KraussMaffei PX 320-2000 unit.

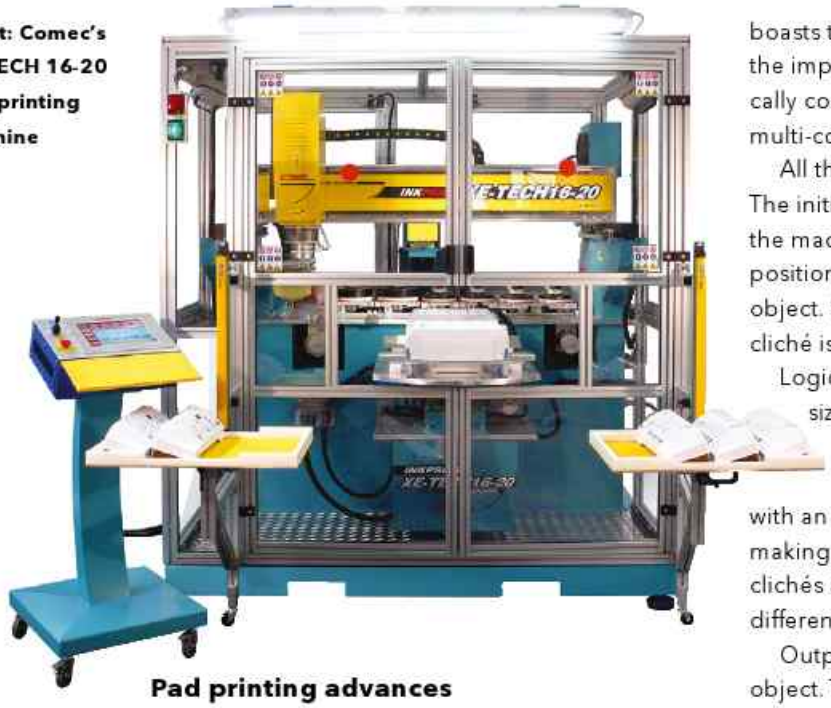
Also active in the IMD arena is **Proell**. Its core business is the development of custom-made chemical products for coating and decorating plastics (and other materials), as well as innovative ink systems for IMD and film insert moulding (FIM) technology, and screen and pad printing inks. Among various IMD-related products the company showed at Fakuma last year was Norilux DC, a formable, abrasion-resistant dual-cure screen printing lacquer, which can be used as a protective lacquer or hard coat on PC, PMMA, ABS and PP films.

Proell says Norilux DC, available in gloss and matt versions, is ideally suited for first-surface coating/protection of products manufactured in IMD/FIM technology.

Proell also showed NoriPress PP, an adhesion promoter for IMD technology that makes back moulding of second surface screen printed PP films with polypropylene injection moulding material possible. Up to now, back moulding was possible only with PP film laminates, the company says.

Automotive decorative parts and panels as well as motorcycle fairings and tool housings can be produced in durable quality by using the PP IMD process. ›

Above: The IMD SI Duo foil feeding unit from Kurz with two precisely positionable foil tracks enables single-image designs to be processed in twin-cavity moulds



Right: Comec's XE TECH 16-20 pad printing machine

Pad printing advances

Despite all the noise about in-mould decoration and labelling, downstream printing using technologies such as pad printing is still dominant. And pad printing continues to develop. At Plast in May, Italian equipment supplier **Comec** said the demands of its leading customers are heading essentially in two directions: expanding the possibilities of customising objects, with more colours, maybe different graphics in different points of the same object; and speed and simplicity of printing – for example having only one machine to carry out the whole process of decorating a group of objects.

Comec says its new XE TECH 16-20 pad printing machine meets both requirements. Comec describes this fully automated system as capable of self-learning the ink pick-up and print points. "In addition, you can make the best suited choice to the work to be carried out between three different pads and six clichés (with hermetic ink cups and ceramic rings)." The on-board computer can store hundreds of programs, which in turn can contain up to 50 printing stages each.

The structure encloses one pad printing head movement group on X and Y axes with brushless motors; a second movement group on Z axis, again with brushless motor and magnetic coupling pad; three pads with quick-coupling devices; a motorised pieces holder; and a programmable pad cleaning device. The machine is also equipped with Comec's Hot Wind 200 hot air blower with adjustable tubes to direct the jet of air wherever it is needed; and a vacuum device for holding the piece being printed.

Another Italian pad printing specialist, **Tosh**, boasts that its new Logica Cartesio can "pad print the impossible." It describes the unit as a "numerically controlled pad printing centre for high quality multi-colour printing on sophisticated 3D objects."

All the pads are arranged radially on a drum. The initial position of the pads is not important, as the machine software makes it possible to freely position the pads on different clichés and on the object. Similarly, engraving of the graphic on the cliché is very flexible.

Logica Cartesio is available in three different sizes, in relation to the number of colours, the size of the piece and the number of colours to be printed. It comes equipped with an interchangeable plate for cliché support, making it possible to freely mix large and small clichés and ink cups. Each spoke can accept different shapes and sizes of pad.

Output depends on the number of prints on the object. Typically, it can range from 150 pieces/hour for 15-20 prints around the object, up to 500 pieces/hour for more simple decoration lay outs.

CLICK ON THE LINKS FOR MORE INFORMATION:

- **www.awa-bv.com**
- **www.viappiani.it**
- **www.verstraete-iml.com**
- **www.stackteck.com**
- **www.kurz.de**
- **www.proell.de**
- **www.comec-italia.com**
- **www.tosh.it**

Right: Printing a ski boot with a Tosh pad printer

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Ahead of AMI's Smart Packaging 2018 conference taking place in Hamburg, Germany, this October, we preview speakers and topics at this key event

Smarter packaging in a connected world

AMI is holding the third annual Smart Packaging conference on 9-10 October 2018 at the Hamburg Marriott Hotel in Germany.

Smart Packaging 2018 again brings together brand owners, retailers, packaging producers, plastics and additive suppliers, active and intelligent technology developers and processing machinery experts to explore the full range of available and emerging technologies. The conference provides the ideal environment to discuss the packaging needs and expectations of brand owners and consumers, as well as exploring the evolution of the packaging ecosystem and its further development.

In today's competitive environment, packaging must do a great deal more than simply protect the contents during transit. New active and intelligent technologies hold the promise of extended shelf life, improved product traceability and authentification, brand security and far greater customer engagement. Smart Packaging 2018 focuses on the latest technological developments aimed at adding value to flexible and rigid packaging.

This year's dynamic programme features many new elements, including the launch of an interactive technology showcase session and a high-level panel discussion exploring further opportunities, challenges, trends and disruptions for the smart packaging industry.

Here we preview the event, with a closer look at the line-up of expert speakers.

Main image: RFID is one of a number of technologies to be discussed at Smart Packaging 2018

Retail environment

Smart Packaging 2018 kicks off with a keynote presentation delivered by **Robert Witik**, Senior Specialist for Sustainability & Packaging Material Science at **Nestlé** in Switzerland. Witik explores the search for smart packaging applications. **Ville Viopio**, Business Development at **Stora Enso** in Finland, starts session one looking at the new world of retail and how connected packaging is transforming distribution models based on consumer behaviour. Next, **Chris Fesen**, Marketing Director Food, **Amcor Flexibles Europe, Middle East & Africa** in Switzerland, delivers a case study analysing how personalisation is being taken to the next level using innovative smart packaging technology.

Security and differentiation

The second session features **Diego Karpeles**, Product Manager at **Gabriel-Chemie Group** in Austria, who explores the technical and decorative differentiation through laser marking of packaging. This is followed by **Tim Marsden**, Project Manager - Printable Electronics at **The Centre for Process**

Above: Amcor Flexibles will discuss how it is using innovative smart packaging technology

Innovation (CPI) in the UK, who presents CPI's work on the roll-to-roll manufacture of smart labels, incorporating hybrid and printable electronics, for the pharmaceutical sector. Closing this session is **Iacopo Bianconcini**, Marketing Manager and Business Development – Closures & Containers Division at **SACMI** in Italy, who focuses on innovative technologies which are ready to disrupt the status quo of packaging, from anti-counterfeiting and personalised marketing to shelf-life extension.

Gillian Ewers, VP Marketing at **PragmatIC** in the UK, starts the third session looking at affordable smart packaging solutions for mass market goods. **Shoko Yamada**, Specialist Functional Surfaces at **Billerudkorsnäs** in Sweden, then discusses paper based electrodes suitable for disposable packaging. Followed by a presentation on a smart NFC/UHF bottle label for the Internet of Things (IoT) delivered by **Brian Weeks**, Managing Director at **CapTag Solutions** in the UK.

Interactive showcase

Following the afternoon refreshment break, we launch the interactive technology showcase. Six technology hubs each host an innovative concept relating to smart packaging. The audience rotate through each showcase in 8-minute power-sessions. The technology hubs will feature: an innovative liquid packaging system that is designed to be recycled, hosted by **Volker Muche**, Packaging Consultant at **Pacproject** in Germany; smart shelf life sensors enabling last mile traceability, hosted by **Rob Cohen**, Vice President - Marketing at **Freshpoint Quality Assurance** in Israel; a concept bringing IoT to the pharmaceutical packaging industry, hosted by **Frank Jäger**, Managing Director at **Faubel & Co Nachfolger** in Germany; a

circular economy compliant stand-up-pouch, hosted by **Henno Hensen**, Consultant at **Hensen Consult** in Germany; interactive paper for smart packaging applications, hosted by **Anouk Dantuma**, Project Leader End Products at **KCPK Centre of Competence Paper & Board** in Netherlands; and, an intelligent label solution providing a new platform to make products smart, hosted by **Thorsten Weyers**, Key Account Manager at **Hologram Company RAKO** in Germany.

To round off the day, a networking cocktail reception will be held in the exhibition area, where delegates and speakers can discuss and debate the conference so far.

Active and sustainable

Day two of Smart Packaging 2018 is opened by **Roland Schultz**, Global Director Marketing Packaging at **Albis Plastic** in Germany, who discusses innovations in active solutions for packaging and how recyclable pouches are extending shelf life. This is followed by a look at simulation-based developments of active packaging with a focus on oxygen scavengers for food applications given by **Astrid Pant**, Research Associate at **Fraunhofer Institute for Process Engineering and Packaging (IVV)** in Germany. The third talk in the session is delivered by **Marta Klanjšek Gunde**, Associate Professor, Senior Researcher at the **Laboratory for Materials Chemistry / National Institute of Chemistry, Ljubljana** in Slovenia who showcases temperature indicators for mainstream consumer food packaging.

Following the morning refreshment break and networking session, **Edward Kosior**, Managing Director at **Nextek** in the UK, makes a recycling presentation on automatic sorting to EU specifications with intelligent labels and addressing difficult-to-recycle materials. **Grégory Coué**, Technical Manager at **Plásticos Compuestos (Kompuestos)** in Spain then looks towards a green revolution with compostable plastic packaging. **Susana Otero Belmar**, Head of Functional Printing Department at **Aimplas Plastic Technology Centre** in Spain, brings the session to a close by analysing eco-friendly packaging strategies for food shelf life extension.

Expert speakers include, from left to right: Chris Fesen from Amcor Flexibles Europe, Astrid Pant from Fraunhofer IVV, Brian Weeks from CapTag Solutions, Roland Schultz from Albis Plastic, Marta Klanjšek from Gundefrom National Institute of Chemistry, Slovenia, Frank Jäger from Faubel & Co Nachfolger, Grégory Coué from Plásticos Compuestos and Shoko Yamada from Billerudkorsnäs

Industry discussion

The final session of the conference takes the form of a panel discussion that explores the smart packaging industry with a closer look at further opportunities, challenges, trends and disruptions. Members of the panel include **Samuli Manninen**, Co-Founder at **Magic Add** in Finland, **Robert Witik** from **Nestlé** in Switzerland and **Roland Schultz** from **Albis Plastic** in Germany. The panel will be chaired by **Christopher Waterhouse**, Managing Director at **IDI Pac** in the UK.

About Smart Packaging 2018

The third Smart Packaging conference takes place on 9-10 October 2018 at the Hamburg Marriott Hotel in Germany. Smart Packaging 2018 provides an international forum for all companies, through the entire value chain for smart packaging, to come together and engage with each other over two days.

Don't miss this opportunity to learn from the experts who can assist you in understanding the possibilities for smart packaging and to identify the solutions to realise them. In addition to the formal conference sessions, the event provides extensive networking opportunities throughout the informal breaks.

To find out more about attending the conference, taking a table-top exhibition space, or becoming a conference sponsor, visit the **conference website** or contact Conference Organiser Emily Renshaw at **emily.renshaw@ami.international**, Tel +44 117 314 8111.

Polymers for 3D Printing 2018

Developing polymers and filaments for optimised 3D printing applications

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The event will provide excellent networking opportunities and evening drinks reception, which will take place in a dedicated exhibition area.

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Manufacturers of mould temperature control units for injection moulding are targeting energy efficiency, precision and production flexibility, as well as meeting Industry 4.0 standards. Mark Holmes reports on new products and developments

Maintaining efficiency through accurate temperature control

The temperature control unit is crucial to efficient and cost-effective injection moulding for maintaining a number of important parameters to accomplish the job in hand and there are a great many issues that need to be taken into consideration. According to Tim Miller, Heat Transfer Product Manager at **Conair**, moulding machine manufacturers are becoming interested in closely monitoring and controlling mould temperature control units (TCU), signalling a definite trend toward increased connectivity between the TCU and the moulding machine.

"The objective is to be able to optimise the mould temperature to more closely match the needs of the process," he says. "Those requirements can change over time based on factors like air temperature and humidity in the plant and so adjustments need to be made more or less continuously. Also, after a job change, all the settings, for example flow rates, need to be adjusted to the new mould. This can be done manually of course, but if the mould temperature controller is connected to the moulding machine control, it can all happen automatically when the rest of the process parameters are uploaded for the new mould setup. At the end of the day, it is about reducing operating costs, improving throughput and part quality.

"We are also seeing increased concern about energy efficiency and that is leading to increased interest in variable speed pumps. Even today, temperature control units are pretty much on/off devices. You run at a constant speed and just valve it down to reduce the flow but that wastes energy. A more efficient solution is to vary the speed of the pump."

Conair is working closely with its suppliers to bring cost-effective advancements in variable-speed technology to the market. "Most moulders, however, look at mould temperature controllers as low-tech and low-cost," says Miller. "Despite how important they can be to their process, when it comes to TCUs, they have a certain price-point in mind and that does not allow us a lot of room to offer these more advanced capabilities. However, as moulders gain more appreciation for the possible payback I think that situation will begin to change."

One piece of new technology that is easy to implement involves the use of Conair's new SmartServices platform. Introduced at NPE, the company says that this Industry 4.0 innovation

Main image: Aquatech has introduced Easytherm, a new line of temperature controllers for Industry 4.0 production

Above: The TW-P from Conair: P stands for premium and these units are available with a higher level of customisation – more pump sizes, for example – than the S or standard model

Right: Installation of Conair temperature-control units

combines powerful equipment monitoring and visualisation functions with advanced cloud-based data storage and analytics. In TCUs, or any auxiliary equipment for that matter, a wireless adapter or 'hub' connects the control to a database that automatically collects and stores process data (set-point and actual temperatures and flow rates) and presents it to the processor in ways that are tailored to their needs. Key performance indicators can be monitored closely with trends analysed over time for process optimisation purposes. Alarms are also logged for analysis, and the system can alert key personnel via text message or email when they need to attend to a particular problem. This increases efficiency and helps to ensure that a critical alarm is not overlooked. In the near future, as SmartServices is more fully implemented, Conair says that it will be able to capture information on such factors as how many times a valve or heater cycles or many hours a pump runs. This means that it will be possible to predict, for instance, when a given heater contactor is likely to fail and take preventative action. The company reports a lot of interest in this kind of innovation.

Aquatech, a **Piovan** company, has introduced Easytherm, a new line of temperature controllers for Industry 4.0 production. The company says that mould temperature control is a crucial parameter in plastics processing and must be steady, strict and precise as it directly influences production costs and the quality of the final product. Easytherm has a new interior and exterior layout, redesigned ergonomic control and high-end components, resulting in a versatile machine that guarantees reliability, accuracy and intelligent consumption management. Easytherm works with temperatures up to 90°C.

According to Aquatech, a temperature controller must operate smoothly in any atmospheric and production environment. In order to meet the diverse requirements of mould temperature control and management, Aquatech has designed Easytherm to be easy-to-use and to minimise the impact of critical production factors. Features include a new deep-drawn tank made of AISI 304 steel, with welding reduced to a minimum, and an Incoloy 825 heater that provides high chemical resistance even against aggressive fluids. In addition, the internal layout of the components has been designed to separate hydraulic and live parts from the electronic boards and controls, which provides protection from vapours, humidity and extreme temperatures. Maintenance work is claimed to be easy due to removable side panels. Key components also include: a brazed plate heat exchanger for a quick and effective cooling phase; a precise level sensor; an optional hot wire flow meter for applications that require maximum accuracy in the continuous monitoring of process parameters; and Speck pumps, single or double, depending on the model.

The company adds that the temperature controllers in a moulding plant are generally placed next to the machines, often not an optimal position for the operator to monitor. Easytherm has been re-designed to make it possible to see the main operating parameters at a glance, including a large 4.3 inch TFT display that is easy to read even in low light environments. The compact design allows it to be easily moved around a factory. Easytherm is also designed for use in Industry 4.0 environments with open standards, such as the integrated OPC-UA server. It connects to the other parts of the system and also externally due to the Ethernet interface. It is also ready to be used with Winfactory 4.0, the Piovan supervision software that allows communication between different machines within a plant.

Wittmann Group has introduced the Tempro Basic C120 temperature controller that features pressure-dependent temperature set-point

Left: Precise temperature control using Easytherm from Aquatech, which is part of Piovan

limiting. The company says that the Tempro Basic C120, specially developed for large-scale consumers, is equipped with radial impeller pumps, which provide high volumetric flow rates for various pressure ranges. This temperature controller offers a high degree of operating comfort and an extensive range of equipment options for every specific application. It is available with different heating and pump capacities – the large version offers up to 46 kW heating capacity and 3.5 kW pump output, as well as a maximum flow capacity of up to 280 l/min.

Directly cooled Wittmann TCUs can operate with temperatures of up to 120°C and are used wherever high cooling capacities are required. In order to achieve high cooling capacities, the cooling water is not supplied indirectly via a cooling coil, as is normal practice, but the water inlet is connected directly to the heat exchanger instead. Consequently, the appliance's maximum operating temperature is indirectly dependent on the water inlet pressure.

Previously, the minimum inlet pressure – 2 bar for the steam pressure curve illustrated in Figure 1 – and the maximum permissible temperature of 120°C were linked to each other in TCUs with direct cooling laid out for 120°C. The consequence was that such appliances could not be operated with low water inlet pressures. In such cases, the pressure setting had to be adjusted manually to the actual operating conditions via the appliance's display.

According to Wittmann, with the new software installed in Tempro Basic C120 controllers, the system pressure (water inlet pressure) is measured continuously, the set temperature value is calculated on the basis of the actual inlet pressure, and a corresponding temperature set-point limit is subsequently set automatically. This set value can then no longer be exceeded. If an operator tries to move the calculated maximum temperature set-point upwards, the LED set value display will flash and issue a warning signal. This indicates that raising the temperature set-point is not possible for safety reasons, since the water inlet pressure is too low. A minimum pressure of 1 bar has been fixed as the lower limit to prevent cavitation in the pump housing.

Wittmann has also developed the Tempro Plus D temperature controller with SpeedDrive option. The company says that energy input must be analysed at every conceivable point in order to achieve optimal power consumption. Mould tempering in injection moulding can play a vital role. This led to the development of temperature controllers, which are now able to use the waste heat of a cogeneration unit for mould heating, and which can reduce the power consumption to the minimum required for the process by using a pump with variable rotational speed.

The utilisation of waste heat became possible through the Eco-Heating option brought to market in 2014, with which the Tempro Plus D90 controller was equipped. With this option, the built-in electric heating element is activated only when the waste heat of the cogeneration unit is not sufficient to maintain the process. The new SpeedDrive option makes it possible to set one of four process parameters (rotational speed, pump pressure, differential temperature or flow) as an additional control variable to achieve energy-optimised operation without jeopardising the process.

Below: Wittmann's Tempro Plus D160 temperature controller, now with SpeedDrive

The company adds that an inspection of the entire temperature control circuit reveals several different areas where energy can be saved. Better insulation of the moulds and tubes can reduce power consumption, particularly with higher processing temperatures (>100°C). Energy savings in the pump can be achieved by using more efficient

Above: The Tempro Basic C120 directly cooled single-circuit temperature controller from Wittmann is also available with an optional touch screen; large version of the appliance on the right

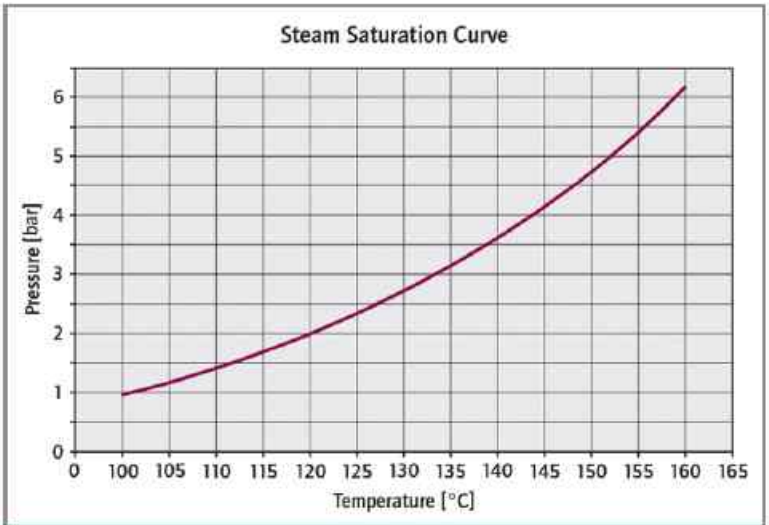


Figure 1: The steam pressure curve illustrates the connection between the water inlet pressure and the maximum operating temperature

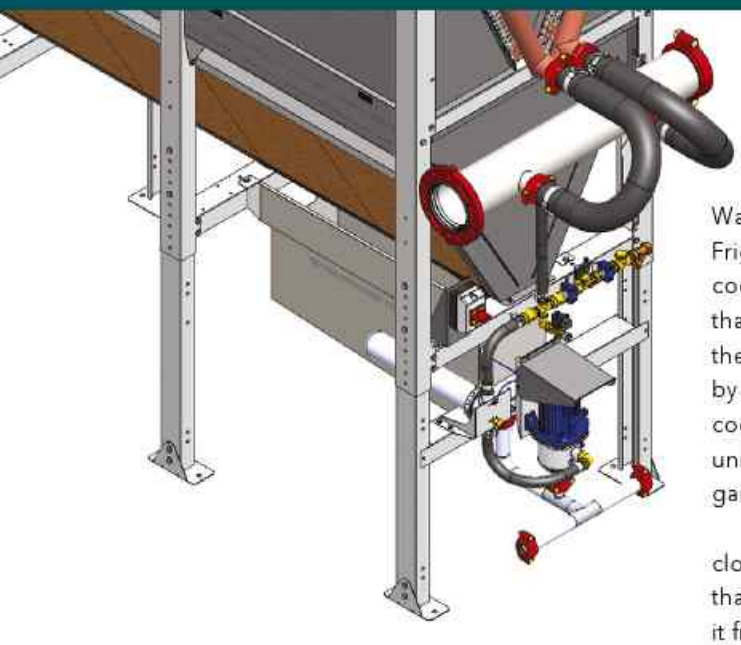
motors. Moving from a 1.1 kW IE2 to IE3 motor can increase efficiency from 79-79.6% to 82-82.7%. The SpeedDrive option consists of a pump equipped with a permanent-magnet synchronous motor. In combination with a matching frequency converter, this configuration reaches an efficiency rating of more than 86%, which corresponds to efficiency class IE4. In this way, the power consumption of the motor can be reduced by up to 30% when other operational parameters of the pump (working pressure and flow) remain unchanged. Additional savings can be achieved by lowering the working pressure of the pump through reducing the motor speed, which cuts the pump's power input and consequently the power consumption even further.

The differential temperature is influenced by mould design (number, diameter, length and geometry of the tempering channels) and the type of connection to the mould (diameter and length of the tubes between the temperature controller and the mould, as well as serial or parallel flow through the tempering channels). The differential temperature is an important indicator of the thermal balance of a mould and the homogeneity of temperature distribution inside the cavities, and it should be pre-defined for every mould, depending on the product to be manufactured. Once the differential temperature has been calculated for a given application, it can be set as a fixed parameter for the Tempro with SpeedDrive and monitored by defining tolerance margins. In the event of any change in the injection moulding machine's process parameters which have an effect on the cycle time, the TCU responds to such a change by increasing or reducing the motor speed of the pump to maintain the set differential temperature.

HB-Therm has developed TCUs using water – not synthetic oil – as heat transfer fluid to cool plastic moulds at operating temperatures of 200-230°C (392-446°F). The water HB-Therm TCUs are claimed to deliver precise cooling while eliminating environmental concerns associated with oil TCUs, which are often used to achieve high operating temperatures. Additionally, water as a heat transfer fluid is an inherently safer option than synthetic oil. Frigel is introducing the TCUs to the North American market as exclusive distributor for of HB-Therm. The high-temperature water HB-Therm TCUs complement the company's existing line of water TCUs rated to deliver and maintain process cooling water from 100-180°C (212-355°F). The portable HB-Therm units are compact with footprints of 1.3-3.2 square feet. With the HB-Therm racking system, users can stack multiple units together to deliver precise cooling to as many as eight mould zones and with an available central control module for as many as 16 separate zones.

Frigel has introduced a CT option for its line of Microgel combination chiller/temperature controller, allowing them to work easily with open cooling towers. The new development allows all plastics processors the ability to use the chiller/TCUs to improve productivity, profitability and quality – not just those who use a Frigel Ecodry closed-loop adiabatic central cooling system as a preferred process cooling water source. The company says Microgel can deliver better part quality, less scrap and improve typical cycle times by up to 20%. The CT option filters out potential open-cooling tower water contaminants supplied to Microgel units, which it says are ideal for machine-side process cooling. It also alerts users to potential problems with contaminated cooling tower water to ensure maximum uptime of the chiller/TCU. Previously, Frigel recommended the use of Microgel units only with an Ecodry central cooling system because it is a closed-loop, clean water system. The CT option is available on the Microgel RCM, RCD and RCX models. ›

Right: HB-Therm temperature controllers



Other options now available on the chiller/TCU include external temperature sensors that complement internal sensors for highly accurate temperature readouts/control at each mould to optimise cooling temperatures further for improved mould performance. In addition, variable frequency drives on the unit's pumps allow them to deliver only the necessary amount of water pressure differential and flow needed, when needed, for peak operating efficiency with the least amount of energy consumption. Finally, digital flow meters can provide a high level of accurate flow data to ensure optimal mould performance based on the unique characteristics of each tool.

Portable Microgel machine-side TCUs with digital controls from Frigel can now capture, display and record energy consumption data to increase productivity and profitability further. The digital controls can also give users the ability to review temperatures, pressures and flow rates. All operating data is stored in a historical log and is accessible via a user-friendly touchscreen. The result is the ability to adjust the unit easily for specific moulding conditions for optimal efficiencies.

Frigel has also introduced variable frequency drives (VFD) and digital flow meters for its line of Turbogel water TCUs for highly efficient, accurate and cost-effective temperature control. The company says that Turbogel TCUs deliver high turbulent flow and accurate temperature control, often improving processing cycle times by as much as 20%. When equipped with a VFD, the unit's pumps now deliver only the amount of water pressure differential and flow needed. The optional digital flow meter can provide highly accurate flow data. "Our first step with customers is to thoroughly analyse process cooling variables involved with their distinct processes, machines and moulds," says Al Fosco, Frigel North America Marketing Manager. "We then customise each Turbogel to match their exact needs."

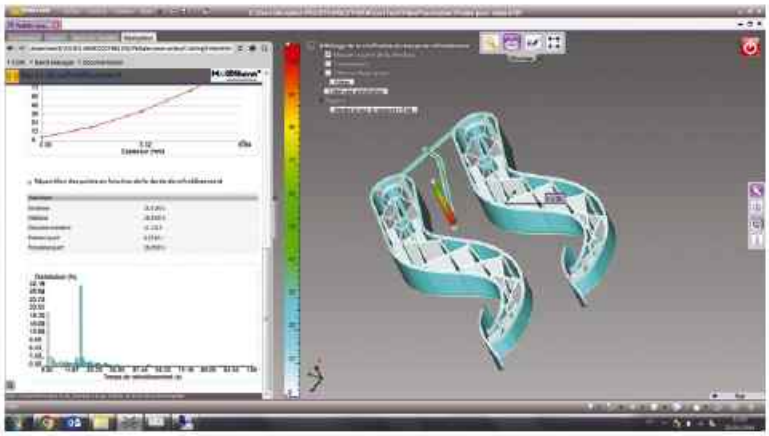
Frigel has also introduced the Ecodry BWR Water Recovery System, which gives users of the Frigel Ecodry 3DK closed-loop adiabatic central coolers the ability to capture and reuse more water than previously possible. The company says that the Ecodry system can reduce water consumption by as much as 95% when compared with an open cooling tower. Now, Ecodry users who equip the unit with the BWR water recovery system stand to gain an even higher level of water savings.

Left: Frigel's BWR Water Recovery System reuses more water than previously possible

The Ecodry unit, which conserves water as a closed-loop system, features an adiabatic chamber that uses a mist to cool process water circulated to it from processing machines. The Ecodry BWR system consists of small tanks, pumps and a drip pan located beneath the Ecodry unit. Controlled by Frigel's 3PR central control system, the system automatically catches unevaporated misting water and recycles it back into the adiabatic chamber for reuse, while simultaneously shutting off the water supply. According to Frigel, the system is ideal for use in unusually humid ambient conditions when small amounts of misting water can go unused. It can also be used with an Ecodry unit configured with an optional ABS adiabatic booster system, which uses extra water in the cooling coil chamber when needed to reach targeted process cooling water temperatures. The BWR automatically discharges any unused water to drain when the adiabatic function is no longer required as ambient temperatures drop, meaning that there is never any standing water in the system.

Eurochiller has developed a small version of its ICEtemp line of thermo-chillers. Known as One, it can provide a cooling/heating capacity able to

Left: Frigel has introduced enhancements to its Microgel combination chiller/ temperature controllers



Above: IPC has launched MoldTherm, a pre-dimensioning tool for estimating the cooling times of an injected part and is designed to reduce the time-to-market for new products

match the needs of an 80-100 tonne injection moulding machine. The company says that the model is a beside-the-machine, water cooled chiller that is designed for Industry 4.0 operation.

For injection moulding, the company also offers the Starty line of water TCUs with submersible pump, open tank and leak stop and reverse functions. In addition, the 3Flows line consists of water or oil units fitted with high pressure pumps to cover more technical applications and the ET line (water or oil units) is able to work on large surface moulds. Units work with fluid temperatures of 90-160°C for water versions and up to 320°C for units with diathermic oil.

Moretto offers a range of stainless steel TEKO liquid temperature controllers in both water and oil mediums, guaranteeing absolute, automatic temperature precision for injection moulding machine moulds as well as extrusion dies, barrels, rollers and baths. Models range from 0.6-54 kW and up to 301°C (574°F).

Matsui America has developed the MC5 mould temperature controllers. The company says that with a more powerful heater, pump and sensor, the MC5 reaches target temperatures within one degree of set-point quickly, and takes samples four times per second to maintain optimum levels throughout production. The MC5's large touchscreen allows storage of up to 64 different temperature settings, pre-set operations, progress monitoring, error detection and maintenance improvements, for example. The G1 panel comes as standard, with the more advanced G3 panel available as an optional upgrade. Maintenance is claimed to be easy because the solenoid valve is located on the outside of the cabinet where it is easier to reach, and solid state relays in heater controls and other critical components are made of stainless steel.

The MC5 is portable, has a small footprint and comes in three sizes. Both standard G1 and advanced G3 designs are for use with low temperature (up to 203°F/95°C) or high temperature (up to 248°F/120°C) water. G3 units offer more programming features as standard.

IPC in collaboration with **CoreTechnologie**, a specialist in 3D CAD model visualisation software, has launched a pre-dimensioning tool for estimating the cooling times of an injected part. MoldTherm is designed to reduce the time-to-market for new products. The software is currently marketed within the 3D Analyzer Plastic Edition package.

IPC says that the software allows plastics manufactures, toolmakers, moulders and designers to optimise production cycles. It encourages innovation by making quick decisions upstream of the product development process. MoldTherm optimises the thermal behaviour of injection tools by quickly estimating the optimal cooling time of the injected part. "During professional market commissions, manufacturers have argued that digital simulation is becoming essential in the design of industrial products, especially for complex products. It offers a better definition of the production parameters and contributes to reduced manufacturing time and costs," says Yves Schmitt, Head of Corporate Relations at IPC.

MoldTherm software is part of IPC's NumPlast digital platform, which offers modelling and digital simulation services in plastics processing. "As an Industrial Technical Centre, we invest a lot of resources to meet the specific needs and requests of professionals in plastics and composites. One of our aims is to support manufacturers to make the digital transition. With MoldTherm, we open up possibilities by offering them the opportunity to test specific digital tools at an intermediate level between the spreadsheet and expert software," says Alban Agazzi, Digital Manager at IPC.

NumPlast also hosts complementary software, such as MCool, which allows the optimal design of mould cooling system control circuits, and Hydro-Mold, which validates the proper balancing of flow and temperature control unit selection. IPC says that ultimately these tools will be integrated into the 3D Analyzer Plastic Edition to offer a complete software suite dedicated to thermal optimisation.

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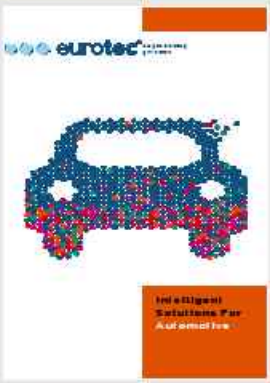

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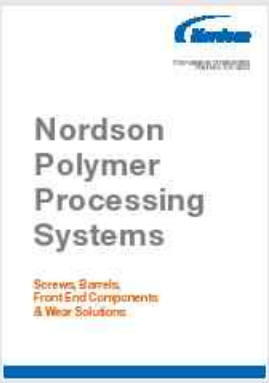

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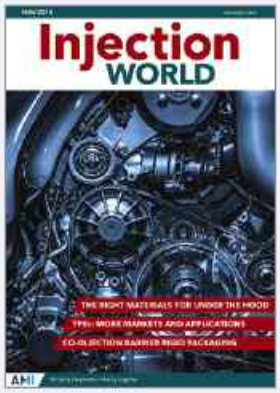

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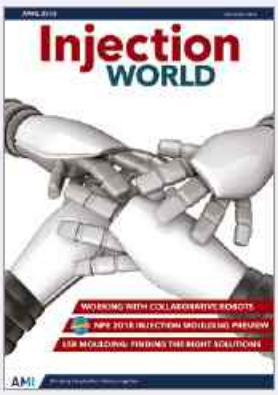

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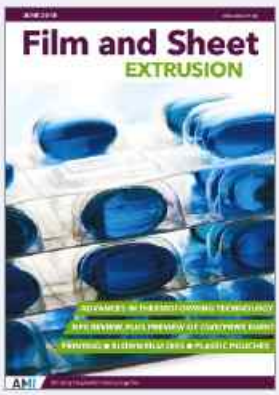

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	14-17 October	Pack Expo, Chicago, USA	www.packexpointernational.com
	16-20 October	Fakuma, Friedrichshafen, Germany	www.fakuma-messe.de
	7-9 November	Expo Plasticos, Guadalajara, Mexico	www.expoplasticos.com.mx
	14-16 November	JEC Asia, Seoul, South Korea	www.jeccomposites.com
	26-29 November	All4Pack, Paris, France	www.all4pack.com
	5-7 December	Plastic Japan, Chiba, Japan	www.plas.jp/en
	5-8 December	Plast Eurasia, Istanbul, Turkey	www.plasteurasia.com/en
2019	**5-8 January**	ArabPlast, Dubai	www.arabplast.info
	12-15 March	Pro-Pack Africa, Johannesburg, South Africa	www.propakafrica.co.za
	19-21 March	EU Coatings Show, Nuremberg, Germany	www.european-coatings-show.com
	25-29 March	Plástico Brasil, São Paulo, Brazil	www.plasticobrasil.com.br
	8-12 April	Feiplastic, Sao Paulo, Brazil	www.feiplastic.com.br
	8-9 May	Compounding World Expo, Cleveland, USA	www.compoundingworldexpo.com/na
	21-24 May	Chinaplas 2019, Guangzhou, China	www.chinaplasonline.com

AMI CONFERENCES

5-6 September 2018	Performance Polyamides, Cologne, Germany
5-6 September 2018	Single Serve Capsules, Vienna, Austria
11-12 September 2018	Polymer Testing & Analysis, Pittsburgh, PA, US
11-12 September 2018	Polymer Testing & Analysis, Berlin, Germany
19-20 September 2018	Wear-Resistant Plastics, Düsseldorf, Germany
8-9 October 2018	Self-Healing Polymers, London, UK
9-10 October 2018	Smart Packaging, Hamburg, Germany
10-11 October 2018	Polymers in Footwear, Cologne, Germany

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

www.ami.international