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PT Plastics Technology

Photo: Messe Düsseldorf

K 2019 PREVIEW

Feature

Advancing 'Autonomous Molding' With a Uniform-Low-Pressure Process

A new low-pressure injection molding process has aroused interest among molders and machine suppliers. In his second article on iMFLUX, the inventor of the process explains how it is evolving to accelerate the overall industry goal of self-correcting molding processes that can compensate for common causes of variation to maintain consistent part quality.

By Gene Altonen, iMFLUX

There's more on the web at *PTonline.com*

BLOG: The Extrusion Solution Institution

Since the inaugural event in 2015, *Plastics Technology*'s Extrusion Conference has entrenched itself in the plastics extrusion sector as the go-to happening, "regardless of what is formed in your die," as explained by conference organizer and *PT* Editorial Director Jim Callari. In a series of blogs, he has broken down the various sessions and topics to be discussed later this month at the Donald E. Stephens Convention Center in Rosemont, Ill. Whether you're in film, sheet, pipe, profile, tube or compounding, read up and make plans to head to Chicago.

short.ptonline.com/extrconf

On the Scene in Schwertberg

Executive Editor Matt Naitove provided a video preview of injection molding machine and automation supplier Engel's K 2019 plans from its global headquarters in Schwertberg, Austria. Hear about lightweight composites for automotive; a new and improved amorphous-metal molding machine with faster cycles and a demo cell combining LSR and metal; roll-to-roll in-mold decorating for a touchscreen; new control technologies, and more.

youtu.be/NE55VNjPkSg

Stay up with our video reports by subscribing to our YouTube Channel: ***short.ptonline.com/yfZBD0uY***

BLOG: Circular K

Ahead of October's plastics extravaganza in Germany—K 2019—three of *Plastics Technology*'s editors participated in press-preview events, all of which pointed to an overarching theme for the triennial event in Düsseldorf—plastics' place in a circular economy. Senior Editor Lilli Sherman wrote about closing the loop in materials and additives; while fellow Senior Editor Heather Caliendo reported on the perspective from leaders at resin and equipment suppliers; and Executive Editor Matt Naitove gave the machinery perspective on circularity with reports from Engel and Erema.

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New Report Details Aging of Manufacturing Workforce

Study from Manufacturing Institute also reveals best practices by companies that are meeting the challenge head on.

I had a wide variety of topics from which to choose as I sat down to write this column: the "greening" of K 2019 (coverage beginning on p. 36); the new boss at the Plastics Industry Association (PLASTICS), on p. 8; the decision of Coke and Pepsi to withdraw their membership from PLASTICS; the upcoming Manufacturing Day; and a few other things. Since some of those items are covered elsewhere is this issue, I decided to tackle another critical and timely subject: Workforce Development.

Jim Callari
Editorial Director

A piece of research hit my email box recently from the National Association of Manufacturers. Titled *Aging of the Manufacturing Workforce: Challenges and Best Practices*, the study concluded that attracting and retaining a quality workforce is one of the top challenges facing the manufacturing industry. As of 2017, the survey noted, nearly one-quarter of the manufacturing workforce is age 55 or older. Kind of scary. The Institute's Center for Manufacturing Research collaborated with Keybridge Research for this study, which was funded by a grant from the Alfred P. Sloan Foundation.

Mack Molding hosts National Manufacturing Day event

The good news is that manufacturers have responded to the challenge in a variety of ways, including boosting recruitment efforts, adopting new technologies and taking steps to retain and maximize the productivity of their older workers (see p. 16 for an article on how one injection molder is dealing with the problem).

Key findings of the report include:

- Most manufacturing firms are both aware of and concerned about the aging of the manufacturing workforce. Almost all (97%) survey respondents report being aware of the issue, and the vast majority (78%) indicate that they are very concerned or somewhat concerned about this change.
- Manufacturing firms are particularly concerned about brain drain (loss of institutional and technical knowledge): 97% of firms express at least some concern about brain drain, and almost half of firms indicate that they are "very concerned" about the issue. Survey results also show that many firms are concerned about a shortage of labor, declining productivity, and rising costs.
- Firms across the manufacturing sector are taking steps to mitigate the impact of the aging workforce on their business. Almost 90% of companies surveyed reported capitalizing on the talents and experiences of their older workers, and of these, 46% report benefiting from older workers "to a great extent."
- Results from the survey and information collected during interviews with manufacturing firms show that those who have successfully dealt with the aging of their workforce target four main objectives, each of which can be achieved through a suite of underlying best practices. Those four main objectives are:

1. **Early Awareness**
   - Create open communication channels.
   - Bring up retirement with employees as retirement age nears.
   - Ensure that employees feel valued and secure.
2. **Knowledge Transfer**
   - Establish and strengthen mentorship and apprenticeship programs.
   - Collect and archive older workers' knowledge using centralized electronic records.
   - Hire older workers with needed knowledge.
3. **Retention and Productivity Maximization**
   - Make ergonomic adjustments and use robotics.
   - Allow workers to transfer to another position internally.
   - Adapt to workers' needs with flexible hours or phased retirement.
   - Encourage workers to return part-time or through project contracting.
4. **Boost Recruitment**
   - Incorporate older workers into recruitment efforts.
   - Use referrals from older workers.

You can go to ***themanufacturinginstitute.org*** and download the entire report. Click on Research on the top navigation bar, then select *The Aging of the Manufacturing Workforce* from the dropdown menu.

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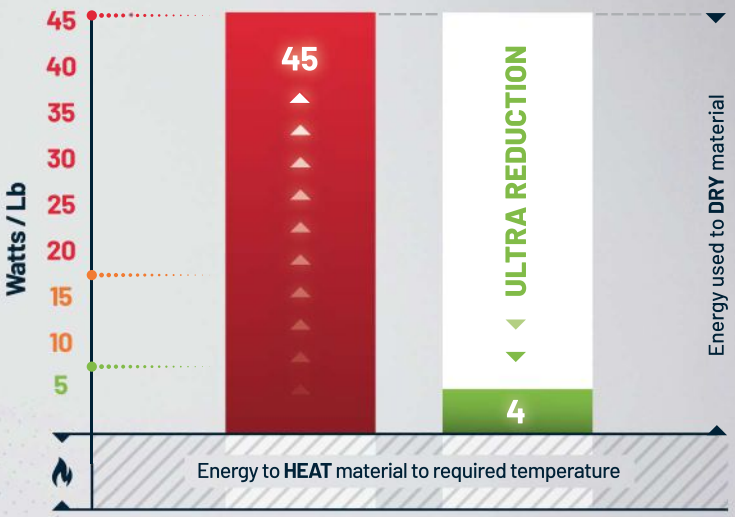

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PLASTICS Has a New President & CEO—Tony Radoszewski

The Plastics Industry Association (PLASTICS) has named Tony Radoszewski president and CEO effective Sept. 16. He comes from the Plastics Pipe Institute (PPI), where he served as president since 2006. He will replace Bill Carteaux, who headed the organization for nearly 15 years, before succumbing to leukemia last December. PLASTICS COO Patty Long served as interim president CEO after Carteaux's passing.

Radoszewski holds a degree in chemistry from St. Mary's University in San Antonio. His career in plastics began in 1980, when he started in polyolefin sales with Phillips Chemical Co. In 1992, he became oil and gas sales manager for Phillips Driscopipe, now Performance Pipe. He later was sales director for the Phillips and Sumitomo Chemical joint venture, Phillips Sumika. In 1995, he joined Advanced Drainage Systems as director of marketing and business development. He worked there for seven years before becoming president of Wentworth Group International.

In his 13 years as PPI president, he led efforts that increased membership, cash flow and profitability, while enhancing member services and strengthening stakeholder relationships, according to PLASTICS.

Of his new job, Radoszewski stated, "I know as I step in to lead the great PLASTICS organization that I have much to learn and I am dedicated to listening to members as a top priority and understanding the opportunities and challenges we have. I have great respect for what has been done to build this association and I am truly honored to be able to lead PLASTICS and, along with our team, take the association to the next level."

Injection Molding R&D Projects Presented at K 2019

The pre-eminent plastics R&D incubator in Germany—and probably the world—will present two injection molding-related projects at the K 2019 show in Düsseldorf next month. First, the IKV (Institute for Plastics Processing) in Aachen will demonstrate a collaborative effort with 13 industry partners to use artificial intelligence to shorten the increasingly complex task of setting up an injection process.

Second, IKV has developed a modular, highly scalable plasma unit for coating the interiors of small, hollow articles like medical syringes, ampoules, coffee beakers and spouts. Such a coating could enhance gas and aroma barrier, reduce friction, or improve chemical resistance. The IKV will host a live demonstration of automatic coating of plastic syringes for low friction.

INEOS Styrolution Breaks Ground for ASA Plant

INEOS Styrolution recently held a groundbreaking ceremony for a nearly 220.5 million lb/yr ASA (acrylonitrile styrene acrylate) plant in Bayport, Texas. The development of the new site is part of a larger plan for the Americas, which includes increased ABS capacity at Altamira, Mexico, while moving ASA production there to the new site in Bayport, which is expected to be operational by 2021.

NGR Launches PET Household Recycling Waste Project

A new project in Austria seeks to show proof of concept for recycling PET household waste into applications beyond PET bottles. Started in June, PET household waste such as blister packaging, thermoformed trays, and films is collected and sorted into a total of six material types. The subsequent flake production—including washing and shredding—is conducted by Kruschitz GmbH.

The PET flakes are reprocessed and decontaminated using NGR's LSP (Liquid State Polycondensation) process in Feldkirchen, where both rPET granulate and rPET sheets will be produced. During the LSP process, the rPET is decontaminated at the molecular level and the polymer chains are extended to increase the intrinsic viscosity.

Teufelberger GmbH uses the rPET to produce strapping with high mechanical strength. Greiner Packaging produces bottles and thermoformed trays for food and nonfood applications. Finally, the products made of rPET are reportedly compared with those made of virgin PET.

The RePETitio-project is backed scientifically by the Transfercenter für Kunststofftechnik GmbH (TCKT). RePETitio is planned to run until September 2020 and is financially supported by the Upper Austrian government with funds from the "Innovative Upper Austria 2020" strategic economic and research program.

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Sidel Buys PET Moldmaker

Sidel has added to its tooling capabilities with the acquisition of Cognac Moules Emballages Plastiques (COMEP), a French designer and producer of molds for PET blow molding. In business for over 20 years, COMEP builds more than 4000

PET molds per year for customers around the world. With around 60 employees, COMEP was an early innovator in low-blowing-pressure technologies. Its Low Pressure Base and Super Vented Mold are said to allow for 30-50% lower blowing pressures and significant energy savings.

SABIC Defers Discussions with Clariant on Merger with its Specialties Business

SABIC and Clariant AG have reached an understanding to temporarily defer discussions regarding the merger of SABIC's Specialties business with Clariant. This is attributed to current unfavorable market conditions. SABIC states that it looks forward to continuing these discussions once conditions have improved, as it is committed to strategic growth in the area of specialties.

A year ago, SABIC acquired a 24.99% stake in Clariant AG as part of its global strategy to become a top-five global leader in specialties. SABIC thus became the largest anchor shareholder in Clariant AG. Seven days later, SABIC announced that it had signed a Memorandum of Understanding with Clariant to open discussions and a due-diligence process, with the shared intent to combine its future stand-alone Specialties business with the additives and masterbatch areas of Clariant.

PET Stretch-Blow Molding Tip: Use Preforms While They're Fresh

Proprietary research from PET blow molding consultant PTI shows that PET bottle performance issues may have their root cause in how long preforms are stored and in what environment. "Our plant-support personnel were frequently being asked what storage duration was acceptable for preforms and what problems can present themselves during longer storage periods," explains Sumit Mikherjee, chief technology officer of PTI. "With amost 40 years of experience in this area, we knew that the longer the preform is stored, the greater the impact on performance—particularly if that preform was stored in a high-humidity environment."

PTI studied 2L and 20-oz preforms that were more than a year old. These preforms were dried under vacuum to get them back to a condition similar to when they were first molded. According to PTI, "Preforms stored three, six or 12 months will each process differently. The older the preform, the more difficult it will be to process so that the container meets performance criteria. The time of year the preforms were injection molded, along with the environmental conditions in which they are kept, will also impact performance."

The problem is not the same as occurs when PET is injection molded without adequate predrying—moisture causes hydrolysis and loss of molecular weight or IV. According to PTI's report, available on its website (***short.ptonline.com/PTI***), the real issue is the direct effects of moisture itself within PET preforms. Newly made preforms have a moisture content near zero, but after long-term storage and/or exposure to high humidity, moisture content can reach upwards of 10,000 ppm. PPI says, "We typically see 3000 ppm preforms after three to six months of moderately humid storage."

This matters because, according to PPI, wet preforms absorb more heat under the same process conditions. Therefore, additional heat may be required to get to the same temperature as a "dry" preform. Moisture may also retard transmission of infrared energy through the preform sidewall, lengthening the time it takes to heat the interior surface to the same temperature. Another important effect is that "moisture acts as a plasticizer, allowing for more stretch." This was seen in free-blowing tests in which "wet" preforms heated and blown under the same conditions as "dry" preforms produced larger free-blow balloons. Other tests show that a wet preform has a lower glass-transition temperature than a dry preform. The practical consequence is that a wet preform may not produce the same material distribution and degree of orientation as a dry preform under the same blowing conditions. For all of the above reasons, "Moisture impacts processing of larger diameter preforms more significantly."

PTI concludes that there is no simple answer to this problem—other than to use preforms promptly after they are molded. It is not practical to dry these wet preforms and reuse them, as it will take too long—up to several weeks. In PTI's study, preforms were dried under vacuum at up to 40 C (104 F), because a higher temperature could cause the amorphous preforms to shrink and distort. There is no suitable equipment available to vacuum dry preforms in a short time, PTI says. "Further, air drying preforms in a resin hopper will not work because the airflow necessary to dry a preform is much different than that needed for pellets."

Bilsing Automation Moves & Expands

Bilsing Automation North America has moved to a new facility in Roseville, Mich., with 15% larger manufacturing space (10,400 ft^2) than its previous location just down the street. A subsidiary of Bilsing Automation GmbH in Germany, the company builds robot grippers for injection molding, as well as products for other industries.

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Dukane Expands Product Offerings in Continuous Bonding & Sealing

Dukane Ultrasonics has acquired all the assets and intellectual property of Aurizon LLC. Aurizon specializes in high-power rotary ultrasonic systems for converting nonwoven materials, bonding textiles and films, and sealing packages. With over 30 years' R&D experience, Aurizon holds a significant patent portfolio. These patents and the team's experience have reportedly improved the speed and capabilities of the ultrasonic continuous bonding process. Over the years, Dukane and Aurizon have worked together closely to develop a generator for continuous ultrasonic bonding, sealing and converting.

This acquisition will create significant synergies and opportunities for Dukane and Aurizon, allowing both companies to share their technical expertise in the hygiene, personal care, medical disposable and packaging industries. For the hygiene market, Aurizon's product line will expand with Dukane's fixed-blade sonotrode technology for customers who don't require continuous rotary bonding. This addition to Dukane's product portfolio will be supported through Dukane's worldwide sales and service network in conjunction with the team at Aurizon.

Aurizon will continue sales, support, manufacturing and design at its Kimberly, Wis., facility. It has an application laboratory for rotary ultrasonic applications, which will be expanded to handle fixed-blade horn technology as well. Moving forward, both Dukane's and Aurizon's electrical and mechanical engineering groups will be working together in bringing new products and technologies to the market. This is Dukane's second recent acquisition; last month we reported on its purchase of laser-welding specialist Blackhawk Technology Group.

Teel Launches Recycling Initiative

Teel Plastics, a custom extruder and injection molder, is partnering with waste-management company Industrial Recycling Services (IRS) to increase the amount of waste that will be recycled from Teel's two main manufacturing facilities in Baraboo, Wis. IRS's capabilities will allow Teel to reduce the waste it sends to landfills by an estimated 200,000 lb annually.

For years, Teel had difficulty finding a firm willing to recycle scrap from its Hitchcock St. facility, which includes mixed plastics, metal and cardboard with various contaminants like adhesives and tape residue. Teel invited IRS to examine the scrap and assess their capability to recycle it. IRS determined it could do so as part of a larger partnership with Teel that included handling the waste from the Teel Court facility as well. For the Hitchcock St. facility, IRS's services will reduce trash to landfill by an estimated 90%, with a goal of taking the facility to zero manufacturing waste to landfill.

ExxonMobil Starts Up New PE Production Line

ExxonMobil has started production on a new high-performance polyethylene line at Beaumont, Texas. The expansion increases capacity there by 65%, or more than 1.4 billion lb/yr, bringing site capacity to nearly 3.8 billion lb/yr.

Bunting Rebrands Divisions

On the occasion of its 60th anniversary, Bunting Magnetics Co., which was founded in 1959 in Chicago but now operates five businesses across the U.S. and the U.K., has simplified its branding under the Bunting name. Formerly, acquired businesses retained their original names and were designated as a Bunting Magnetics Company. Going forward, this naming structure will be consolidated to: Bunting—Newton (Newton, Kan.); Bunting—Elk Grove (Elk Grove, Ill.); Bunting—DuBois (DuBois, Pa.); Bunting—Berkhamsted (Berkhamsted, U.K.); and Bunting—Redditch (Redditch, U.K.).

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Technology Collaboration to Evaluate Potential of 3D-Printed Automotive Production Parts

A German and Austrian consortium aims to develop new materials, printing methodologies and post-processing technologies for durable stereolithography (SLA) products using Digital Light Processing (DLP), with a focus on automotive applications. Called SYMPA, it is sponsored by the German Federal Ministry of Education and Research (BMBF) and the Federal Ministry of Austria Transport, Innovation and Technology (BMVIT).

SYMPA aims to overcome some of the weaknesses of current SLA materials in mechanical properties, durability and UV stability. Goals include development of a new photosensitive polymer with increased long-term thermal and mechanical properties, fiber reinforcement of the polymer, and surface modification to enhance environmental resistance.

SYMPA is coordinated by the Institute of Aircraft Design (IFB) of the University of Stuttgart and involves partners including material specialists, machine producers and research institutes. For example, Henkel has developed high-performance photopolymers with improved mechanical and thermal durability for SLA. The Institute of Aircraft Design (IFB) has worked with fiber-reinforced SLA materials for greatly increased mechanical properties and fatigue limit. Rapid Shape GmbH offers high-speed 3D-printing systems, using readily adaptable open technology.

Joanneum Research and INOCON Technologie GmbH are specialists in development and application of plasma technology for coating and activation, including surface modification for better mechanical and environmental resistance. And cirp GmbH is an experienced 3D-printing service provider that can perform technology demonstrations of real automotive structures and improved design processes for SLA components.

Robot Grippers Assembled in USA

2019

Schunk will now assemble grippers in the U.S. It completed a 40,000 ft² expansion in Morrisville, N.C., earlier this year, resulting in 19,000 ft² more manufacturing space plus 22,000 ft² additional office and training space. Local assembly of robot grippers previously imported from Germany means faster response time and ability to customize products with standard components in stock.

Covestro Steps Up Development of Thermoplastic Composites

Covestro is further developing its offerings and capabilities in continuous fiber-reinforced thermoplastic (CFRTP) composites in response to market trends and growing demand from customers.Its Maezio brand of CFRTP composites are based on continuous carbon fibers impregnated with thermoplastics like polycarbonates. A new tape line has been commissioned in the company's laboratory on Leverkusen, Germany, to develop new products with different fiber and resin combinations. It will be scaled up for commercial production at Markt Bibart in South Germany.

One product under development is a TPU-based CFRTP, which boasts excellent chemical resistance and flexibility over a wide temperature range. There's a strong demand in footwear and sports equipment for such a product, Covestro says.

At the same time, new hybrid injection molding machines are running at Covestro's CFRTP locations in Germany and China to build on processing know-how for complex 3D composite parts. Such hybrid machines combine heat forming of organic sheets and tapes with injection overmolding. Covestro is working with machinery and processing partners such as KraussMaffei and Engel to offer customers full support in product development.

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Molder's Philosophy of 'Giving Back' Helps Attract New Employees

R&D Plastics participates in numerous programs to further plastics education with local universities and high schools. This effort breeds good community relations and helps attract new employees.

By Matthew Naitove
Executive Editor

Running a molding business these days may mean more than machines and pellets, revenues and expenses. In an era when plastics are under daily attack in the press and in legislatures, and when scarcity of experienced personnel is a chronic frustration, processors might do well to put community relations high on their list of priorities.

A strong proponent of that philosophy is R&D Plastics, owned and run by CEO Rod Roth (son of Merrill Roth, founder of Grant & Roth Plastics) and Sal Gonzalez, v.p. of operations. Located in Hillsboro, Ore., R&D Plastics is a medium-sized custom injection molder serving domestic and foreign manufacturers in medical, electronics, transportation, recreation, wastewater treatment, and defense industries. Started in 1996 (after the sale of Grant & Roth to SPM) and approaching $8 million in annual revenues, the business operates out of a 48,000 ft² plant with 60 employees and 18 presses from 40 to 720 tons.

Rod Roth receiving an award from Western Washington University's Plastics & Composites Engineering Program (Bellingham, Wash.) in recognition of a lifetime of contributions and support. With him is Nicole Hoekstra, Prof. of Plastics & Composites Engineering and director of the Technology Development Center.

A FOCUS ON PEOPLE & COMMUNITY

Focused on competitive pricing for high-quality parts, combined with a high level of technical support and service, R&D Plastics practices a personal approach to business. "We focus on a smaller number of customers in order for management to be involved in servicing all accounts," says Roth.

"Rod, Sal and their team make this place so tight-knit that it's like a family business—and in some ways it almost is," observes Don Williams, manager of Pacwest Industrial Sales, regional representative for Wittmann Battenfeld, which has become a favored supplier for robots at R&D Plastics. (The molder also just bought its first Wittmann Battenfeld injection press.) "Many former Grant & Roth employees from Rod's dad's business are still there, 25 years after that business was sold. It's a real testament to the people-focused culture they've built here that people come seek them out for work, and they stay for a long time once they get in the door."

Giving back to the community is a core value of R&D, and it starts at the top. Roth and Gonzalez have both made it a major part of how they run their business. For nearly a decade, Gonzalez taught classes at two local colleges, Portland Community College and Clark College. In his limited spare time, he worked with students in their plastics labs, training them in skills to land jobs in the plastics industry. Sometimes, Gonzalez was directly training employees of R&D's competition, but he considered that a positive: "It's a really small industry, especially out here in this region. We see competitors' employees come in all the time; but in our eyes, by being friendly and ourselves, and expanding their knowledge, we're helping to support the entire industry. Plus, who knows, they might change jobs down the road and remember the good people and great training they got from us!"

Roth, meanwhile, also supports local higher education. He sponsors three scholarships at Western Washington University's Plastics and Composites Engineering program, brings in interns from the school every summer, and is a guest lecturer in classes. ►

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This close relationship with the university has led to the school being somewhat of a feeder program into R&D Plastics, with talented graduates moving from interns into full-time employees. Around eight graduates have followed this path so far.

R&D also constantly brings people into its plant from around the region to learn about what the company does and to train them in practical skills. Every year, R&D hosts an open house for anyone from the community who wants to come, usually drawing a crowd of around 100. R&D feeds them and gives tours of the plant.

In addition to the open house, R&D hosts a "Lunch and Learn" every month for anyone who wants to attend. Topics are varied and encompass a wide range of skills, recent examples including mold texturing and sonic welding.

Quarterly, R&D will go over some bigger topics, including part design, material selection and mold design—also for anyone who wants to attend. As with its support for local schools, these events regularly host competitors' personnel, but R&D sees the plastics industry as a community and lives by the mantra that "building good will is good business."

INSPIRING A NEW GENERATION

Every year, R&D hosts a plastics industry tour in the Portland area for engineering students of Western Washington University. R&D hosts about 45 students and faculty, loading them onto a tour bus early in the morning and coordinating thorough tours of plastics-related companies such as moldmakers and prototype shops, including Nike's in-house molding and extrusion operation, GMNameplate injection molding, PMT plastics metalizing, and a few OEM manufacturers such as Daimler, always finishing up with a tour of R&D Plastics. Some of the students take full advantage of this and experience the "Portland tour" more than once during their student track.

R&D even helps train competitors' personnel, "But who knows, they might change jobs down the road and remember the good people and great training they got from us!"

R&D also participates in a "Manufacturing Day" event, inviting about 75 to 80 local high-school students to educate them about the plastics industry, the injection molding process, and career opportunities. R&D sees the value in supporting the interest of future job seekers, as well as the importance to the community of supporting job opportunities for local people.

"We really respect what R&D does day in and day out to support their community," adds Jason Cornell, Wittmann Battenfeld's West Coast regional manager for robots and automation. That sentiment is echoed by Williams: "R&D gives back more than anyone else I've ever known in this industry, and they've earned their status as godfathers of plastics out here."

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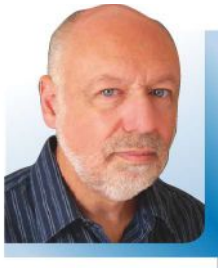
MATERIALS

PART 1

The Fundamentals of Polyethylene

You would think we'd know all there is to know about a material that was commercialized 80 years ago. Not so for PE. Let's start by brushing up on the basics.

Continuous developments in PE have allowed processors to engineer films thinner and stronger than ever. (Photo: Reifenhauser)



By Mike Sepe

Polyethylene has been commercially available for 80 years. With all that time to gain experience, you might expect that we would have learned everything there is to know about this material family. However, judging by the conversations I have with people about selecting the correct PE for an application, the industry has a lot to learn.

Polyethylene is considered a "commodity" material, a designation that gives the impression that not much thought needs to go into picking the correct grade of material. But PE can be remarkably complicated, simply because it is the only polymer that is available across a wide range of densities.

Density is usually an inherent property. All polycarbonates have a density of 1.19-1.20 g/cm³; all polypropylenes cover a very narrow range from 0.898-0.905 g/cm³; and the density of PBT polyester is 1.31 g/cm³. It is possible to alter the density of any material, but such adjustments involve changes in composition. The addition of plasticizers will reduce the density of PVC; most impact modifiers will reduce the density of the base resin to which they are added; and fillers and reinforcement will typically increase the density of a material.

But PE can be made to densities that cover a range of 0.86-0.97 g/cm³ without altering the molecular composition one bit. And across this range, the polymer can present a wide range of properties.

Selecting the right grade of PE has always been more difficult than selecting other resins, precisely because of the unusual versatility of the polymer.

It wasn't always this way. Polyethylene, like many polymers that we rely on commercially today, was created by accident. Researchers experimenting with gases under high pressure discovered that when they conducted experiments with ethylene gas, they obtained a solid compound that was the result of polymerization of the ethylene molecule. It took about six years to commercialize the material, and by today's standards the polymerization process was crude and produced a very narrow range of products.

Today we call these materials low-density polyethylene (LDPE). But this nomenclature did not exist at the time because there was no such thing as high-density polyethylene and no understanding that such a material might even be possible. We have understood for some time that LDPE is made of up of chains that contain a significant amount of branching. The long branches prevent the chain backbones from packing closely together. This limits the ability of the material to crystallize and reduces the intermolecular attractions that are responsible for providing load-bearing properties such as strength and stiffness.

The initial use of PE was as insulation for wire and cable, so the flexibility of LDPE was a positive attribute. However, if we were to try to make a product such as 5-gal pail out of LDPE, fill it with 40-60 lb of contents, and then stack the full containers three or four high, they would quickly collapse. So understandably, PE applications were somewhat limited through the 1940s and into the mid-1950s.

Enter Karl Ziegler and Guilio Natta. In 1954, working independently and somewhat competitively, they discovered catalysts that allowed the polymerization of ethylene to take place without the extreme temperatures and pressures needed previously. More importantly, the resulting molecule was largely free of the branches that characterized the results of the high-pressure processes. ►

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MAKING THE EXPERIENCE MATTER

These linear molecules could pack closer together, creating a very different set of properties. High-density polyethylene (HDPE) was stronger, stiffer, and harder, all consequences of the higher degree of crystallinity that arose from the more regular arrangement of the linear polymer chains. It was also less impact resistant, especially at cold temperatures. But the enhanced strength and rigidity of the material made products like those 5-gal pails possible.

Two researchers at Phillips Petroleum had discovered a similar process about a year before Ziegler and Natta, and this system for polymerizing PE is still known today as the Phillips process. However, the technical accomplishment became of subject of long, drawn-out litigation that was not settled until the 1980's, and by that time the Ziegler-Natta designation had firmly taken root and they shared the Nobel Prize in Chemistry in 1963 for their accomplishment.

Once these transition-metal catalysts became known, the world of polyethylene expanded rapidly. A wide range of densities from 0.91-0.97 g/cm³ could be manufactured, with a corresponding wide range of properties. Additional advances produced linear low-density polyethylene (LLDPE) in the late 1970s. This material introduced branching in a more controlled manner than was possible in traditional LDPE.

At about this same time a new revolution in catalysts was just getting started that would have far-reaching consequences for polyethylene. In 1977, Walter Kaminsky at the University of Hamburg demonstrated the utility of metallocene catalysts in polymerizing PE. It has been a long, winding road of development for these materials, but through the late 1990s and into the first two decades of the new millennium, PEs made with these new catalyst systems added forms of the material that were previously impossible. Metallocene-catalyzed LLDPE is more difficult to process than Ziegler-Natta LLDPE, just as the early versions of LLDPE were more challenging than traditional LDPE. But as processors caught up with these materials, the improvements in performance became evident. Films could be downgauged substantially while producing structures with equivalent performance. Clarity, dart-impact resistance, and tear strength were all improved.

The increased level of control over polymerization afforded by these catalysts led to a new set of polyethylene materials with densities as low as 0.86 g/cm³. Low levels of crystallinity produced a family of materials referred to as plastomers: flexible, tough materials that could duplicate the properties of materials like ethylene-vinyl acetate (EVA) copolymer at much lower densities and with improved levels of thermal stability in the melt.

With all this development, the task of selecting the right PE for an application has become increasingly complicated. Selecting the right grade of PE has always been more difficult than selecting other resins, precisely because of the unusual versatility of the polymer. In most polymer families, unfilled and unmodified grades are distinguished primarily by their molecular weight. Higher-molecular-weight grades perform better but are more difficult to process because of their higher melt viscosities. In general, the molecular weight of PE is captured in the melt flow rate or melt index specification.

Without identifying the density, the property profile of PE cannot be known.

But with PE there is another property that must be considered when defining the performance of the material: the density. The ability to specify two properties instead of one provides greater variety, but it also makes it more difficult to arrive at an appropriate selection. The person selecting the material must understand how properties change as a function of both molecular weight and density. (Molecular-weight distribution is yet another factor that must be considered, but we will deal with that later).

In our next column we will define the interaction between molecular weight and density and then go on to illustrate the importance of knowing how to select grades of PE based on these two interrelated but ultimately independent parameters. PT

ABOUT THE AUTHOR Mike Sepe is an independent, global materials and processing consultant whose company, Michael P. Sepe, LLC, is based in Sedona, Ariz. He has more than 40 years of experience in the plastics industry and assists clients with material selection, designing for manufacturability, process optimization, troubleshooting, and failure analysis. Contact: *(928) 203-0408 • mike@thematerialanalyst.com*.

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INJECTION MOLDING

Graphing Injection Pressure: What Should Pack & Hold Curves Show?

Are you sure your press is doing what you want? Visit your controller often to ensure your machines plot the pressure vs. time graph for all your processes. Here let's focus on pack and hold.

In my May 2019 column I prodded you to get the injection pressure vs. time graph working on your injection molding machines.

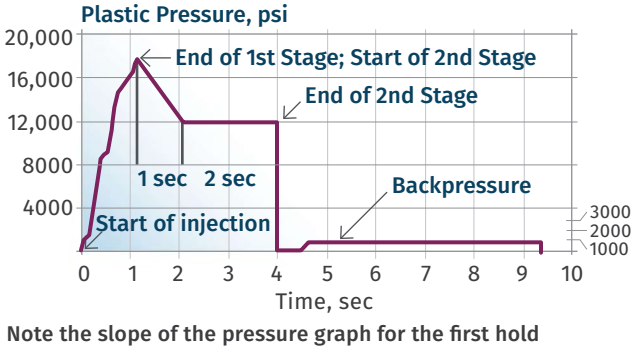
By John Bozzelli

Plotting injection pressure vs. time is a great way to capture your process and learn how your machine and controller operate.

But there are times when the result is not what you'd expect. While this injection-pressure graph varies for different processes, there also are similarities. That is, curves will not look *exactly* the same for all processes, but should be similar in basic aspects. In this column I'll focus on pack and hold, also known as second stage.

You may set up the process parameters on the controller the way you want them to be, but the controller and/or machine may not handle the setpoints as you'd anticipate. Pack and hold may seem like two different conditions, but on most machines, they are *not* two different functions. We will start with the inputs on the controller screen, and then take a look at the possible results.

FIG 1 Machine A Process (First Timer is Ramp Time)



Note the slope of the pressure graph for the first hold pressure and time (1 sec). This is a ramp time. That is, the controller makes the machine go from first-stage pressure to the set second-stage pressure in 1 sec. Shape of curve for hydraulic pressure would be identical.

A typical controller may have a first- and second-stage setup on the same page or different pages, so find the page that sets up second stage. The controller may also give you the option of having different hold pressures for different times. Both of these options are handled differently by machine manufacturers.

I would like to start with a typical input, where second stage is set up to provide the same pressure for two stages (see Table 1). With these identical inputs into Machine A and Machine B it is possible, depending on the machine manufacturer and controller, to establish two different processes (see Figs. 1 and 2).

TABLE 1 Representative Controller Inputs on Machines A & B for Second Stage

	Pack Stage 1	Pack or Hold Stage 2
Time	1 sec	2 sec
Pressure	12,000 psi	12,000 psi

TABLE 2 Controller Inputs for Machine A to Match Process in Machine B

	Pack Stage 1	Pack or Hold Stage 2
Time	0.1 sec	2.9 sec
Pressure	12,000 psi	12,000 psi

In Fig. 1 note the slope of the pressure graph for the first hold pressure and time (1 sec). The 1 sec on the controller for Machine A is a ramp time. That is, the controller makes the machine go from first-stage pressure to the set second-stage pressure (12,000 psi) in 1 sec. The next timer of 2 sec is a time at a given pressure, in this case 12,000 psi.

In Fig. 2, Machine B provides a different process than is shown in Fig. 1. In Fig. 2, both timers are times at a given pressure of 12,000 psi for 1+2 sec, or 3 sec total, for second stage. The machine switches from first to second stage as fast as it can and provides the rapid, sharp drop in pressure to the set 12,000 psi at the end of fill or first stage.

The setpoints on both controller screens are identical, but the processes are not. It depends on how the controller/machine is programed to handle the inputs. The two processes appear to have ►

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the same setpoints but they are *not* the same. The only way to tell what you have is to plot the pressure vs. time graph.

For the process graphed in Fig. 1, the first set time is not a time at the set pressure of 12,000 psi but instead a "ramp" time. That is, the controller takes this 1 sec of time input as a ramp time to go from end of first stage to the set second-stage pressure.

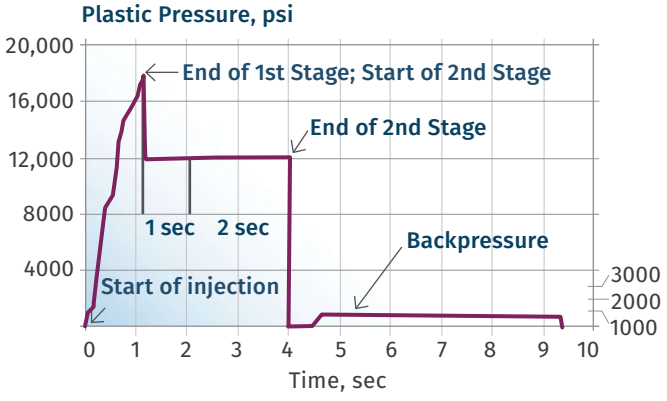
So, if there are these two options, which is right? Whichever one makes an acceptable part. In my experience the process graphed in Fig. 2 is normally preferred for acceptable parts. It is significantly kinder and gentler to the parting line, resulting in less parting-line wear.

You may think you set up the process parameters on the controller the way you want, but the controller/machine may not handle the setpoints as you expect.

If you wanted Machine A to provide the same second stage as Machine B, see Table 2 to show how to set up the Machine A controller page.

Bottom line: Ensure your machines plot the pressure vs. time graph for all your processes. Visit this page on your controller often. The plot documents the process and provides details that happen too fast for most of us to catch with the human eye. Are you sure your machine is doing what you want? PT

FIG 2 Machine B Process
(Both Times are Time at a Pressure)



In this process, both timers are times at a given pressure of 12,000 psi for 3 sec total for second stage. The machine switches from first to second stage as fast as it can and provides the rapid, sharp drop in pressure to the set 12,000 psi at the end of fill. This process is significantly kinder and gentler to the parting line, resulting in less parting-line wear. (Shape of curve for hydraulic pressure would be identical.)

ABOUT THE AUTHOR: John Bozzelli is the founder of Injection Molding Solutions (Scientific Molding) in Midland, Mich., a provider of training and consulting services to injection molders, including LIMS, and other specialties. Contact *john@scientificmolding.com*; *scientificmolding.com*.

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EXTRUSION

Understanding Viscosity in Extrusion

Both the power-law coefficient and the consistency index must be considered to calculate viscosity.

By Jim Frankland

Viscosity for non-Newtonian polymers is a combination of increasing temperature and shear rate, as described by the following relationship:

$$\eta = m\gamma^{n-1}$$

where viscosity (η) equals consistency index (m) times the shear rate (γ) to the power-law index (n) minus 1.

Generally, only rheology experts discuss the effects of the consistency index. The consistency index, or viscosity change with increasing temperature, is largely dependent on the energy input to the polymer by shear from the screw rotation. That is, as the shearing raises the polymer temperature by viscous dissipation or conversion of mechanical power to temperature, the viscosity additionally decreases due to the higher temperature and adds to the shear thinning. The consistency index describes that rate of decrease due to increased temperature.

The shear-rate curves in the accompanying graph illustrate the effects of both shear and temperature on viscosity. The individual curves are due to shearing alone, while the spacing between the lines is the temperature effect on viscosity.

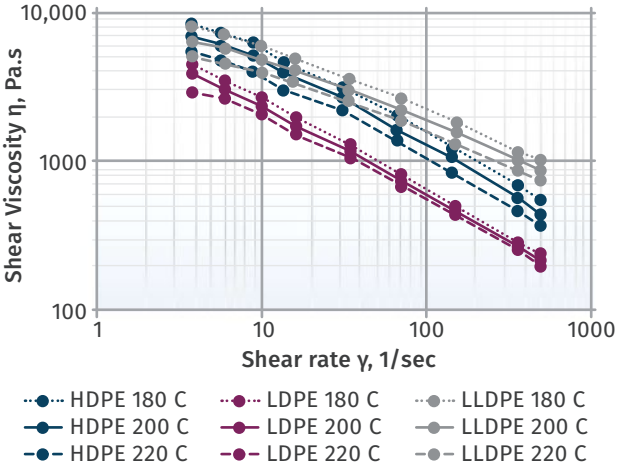
The accompanying table shows values of the consistency index and the power-law coefficient for several common polymers at temperatures in their processing range.

Two polymers at similar melt index or melt flow can have vastly different viscosities at the elevated shear rates during processing.

The shear-thinning characteristics of various polymers are often categorized solely by the power-law coefficient, but the consistency index can have just as significant effect on the final viscosity and has to be considered. As the list of polymers in the table shows, the calculated viscosities from the chart at shear rates of 100 sec^{-1} do not fall in the same order as the power-law coefficients because of that consistency-index effect.

As a result, two polymers of similar melt index or melt flow can have vastly different viscosities at the elevated shear rates during processing. Melt-index and melt-flow measurements

Effects of Shear and Temperature On Viscosity of Various PEs



Viscosity can be impacted by both shear and temperature. The individual curves are due to shearing alone, while the spacing between the lines is the temperature effect on viscosity. (Source: Journal of Polymer Engineering)

by capillary rheometer are at very low shear rates, where shear thinning is almost non-existent. Due to the multiplying effect of power-law coefficient and consistency index, an HDPE and a PP at identical shear rates and slightly different temperatures can have a difference in viscosity where the HDPE is three times as viscous as the PP. This means that the melt temperature of the HDPE on the same screw design is going to be much higher than the PP.

Use of the simple viscosity calculation can greatly assist in analysis of extruder power requirements, melt temperature and polymer flow for different polymers without the use of shear-rate/viscosity graphs

Interestingly, some polymers can reach a near autogenous or adiabatic shear rate, where the viscosity drops proportional to the shear rate or screw speed, such that further heating through viscous

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Consistency Index & Power-Law Coefficients of Polymers

Polymer	Consistency Index	Power Law Coefficient	Temperature Region, C
HDPE	2.0×10^4	0.41	180
LDPE	6.0×10^3	0.39	160
Nylon 66	6.0×10^2	0.66	290
PC	6.0×10^2	0.98	300
PP	7.5×10^3	0.38	200
PS	2.8×10^4	0.28	170
PVC	1.7×10^4	0.26	180

Source: International Plastics Handbook, Table 3.11

dissipation is minimized and the power requirement increases only a small amount. For example, I have processed PP at 1500 screw rpm with normal melt temperatures, and the increased power requirement remained largely proportional to the output due to the autogenous effect. However, that's not true of many polymers.

The actual calculation of the motor load using the calculated viscosity is quite complicated and generally requires computer simulation. However, the calculated viscosity can be a useful tool for approximation of the viscosity and the resulting screw power requirements when coupled with the calculations for viscous dissipation of different polymers on single-screw extruders of different sizes and L/D ratios. Power-law coefficient and consistency data can be found on the internet or from the polymer suppliers. PT

ABOUT THE AUTHOR: Jim Frankland is a mechanical engineer who has been involved in all types of extrusion processing for more than 40 years. He is now president of Frankland Plastics Consulting, LLC. Contact *jim.frankland@comcast.net* or *(724)651-9196*.

TOOLING

PART 1

The Basics of Tapered Interlocks

Various types of interlocks are available to molders. Here, we discuss the oldest and most common types of interlocks—those with a tapered or angular shutoff.

When selecting the type, size and location of interlocks for an injection mold, base your decision on what you need them to do. They can align any two mating mold plates or component parts. They can protect fragile shutoffs. Or they can provide support to prevent deflection. Various types of interlocks are available to molders. None of them are the best at performing all three functions—align, protect and support. This article will discuss the oldest and most common types of interlocks—those with a tapered or angular shutoff.

By Jim Fattori

Let's first discuss why every mold needs interlocks. There is a clearance between leader pins and their bushings of 0.0015 to 0.0025 in., and that's when they are brand-new. Unless you jig-grind the bore holes for the pins and bushings, there is going to be a slight misalignment due to the milling machine's positional and angular capabilities.

Now factor in the inevitable wear of the bushings, especially if they are made of relatively soft aluminum bronze. Over time, the bushing bore holes can also elongate. I've seen bushings that were so loose, set screws were installed from the sides of the mold to prevent them from falling out.

The molding machine itself adds to the need for interlocks. The platens are never absolutely parallel. They too have bushings, and support pads that wear, which allow the platens to tilt. The older the machine, the more the tilt. When a mold without interlocks is hung in a machine, one half of the mold is likely to be lower than the other by an amount equal to all of these combined clearances.

Consider how far apart you mount conical interlocks, and what the expected temperature difference might be between the two halves of the mold.

Bottom line: Leader pins are nothing more than a preliminary method of roughly aligning the two halves of a mold. How many times have you heard the end of a leader pin bump the entrance to its bushing when the mold closes? If a mold does not have any interlocks to precisely align the two halves, there is a strong likelihood that the molded part will have an uneven wall thickness. That might not be an issue with a thick-walled part, but on a thin-walled part it will radically change the fill pattern, which can lead to all sorts of problems.

FIG 1

There are two types of off-the-shelf interlocks with a tapered or angled shutoff: conical (left) and rectangular.

TYPES OF TAPERED INTERLOCKS

There are two types of off-the-shelf interlocks with a tapered or angled shutoff: conical and rectangular, as shown in Figure 1. The angle of the taper is typically 10° per side in the U.S., 15° in Europe, and 5° in Asia. These interlocks align two mating components only when the mold is fully closed and their angled faces are touching. That is their primary function—alignment. Conical interlocks align plates or components in a full 360° about their center axis. One common misconception is that rectangular interlocks only align plates or components in one direction. That's not true. Even though the two plates are free to ►

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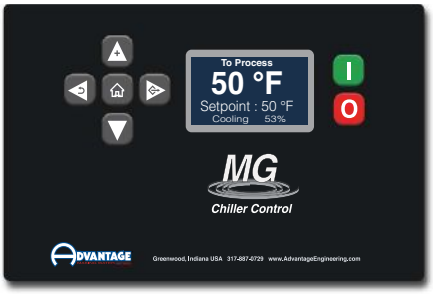

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slide parallel to their length, it is their length that also prevents any angular or rotational misalignment.

TABLE 1 Surface Contact Area of Interlocks

	Diam. or Length	Contact Area, in.^{2}
Conical	1/2 in.	0.4
	3/4 in.	0.6
	1 in.	1.0
	1.5 in.	1.6
Rectangular	2 in.	1.0
	4 in.	2.5
	6 in.	3.7

Rectangular interlocks have a lot more surface contact area than conical interlocks, as shown in Table 1. They are also anchored more securely in the mold. That is why they are the best at overcoming misalignment, and they will last longer than any other type.

Another misconception is that conical and rectangular interlocks do not provide any protection to mold components that have an angled shutoff prior to the mold being fully closed. That's not entirely true. As long as the shutoff angle of the mating components is greater than the interlock's shutoff angle, the components are protected. That is why at least two mold-component suppliers (one domestic and one offshore) offer conical interlocks with a 1°, 3°, 5° or 10° taper per side. And one offshore supplier offers rectangular interlocks with 1°, 3° or 5° taper per side.

Technically, any mating steel components that have an angle of 7° per side or less is called a self-locking taper. However, the amount of locking or holding power depends on several factors, such as the coefficient of friction between the mating parts, the surface roughness, the hardness of the materials, the presence of any lubricants, and the force applied to them. In injection molds there is a good possibility of having a locking issue with an angle between 1° and 3°, but unlikely that you will have one with an angle greater than that.

Rectangular interlocks should be installed perpendicular to the sides of the mold, preferably on the centerlines, forming a "plus sign" configuration.

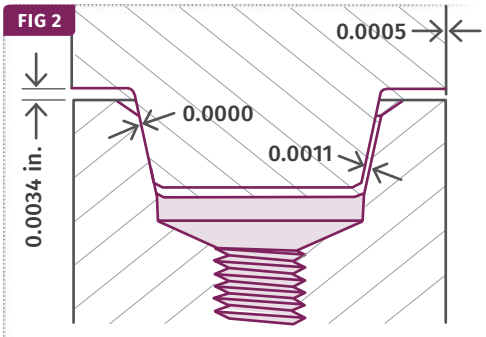
If you use interlocks with a shallow taper, keep in mind that the amount of misalignment cannot exceed the length of the opposite side of the angle, as opposed to the length of the adjacent side or the hypotenuse. Otherwise, the top of the male and female halves will hit each other, instead of engaging each other.

THERMAL EXPANSION

Conical interlocks have one significant drawback. If for any reason one half of the mold is hotter than the other, the two mold halves will expand different amounts and the interlocks will be out of alignment.

The coefficient of thermal expansion for carbon steel is 6.7 × 10^{-6} in./in.-°F. The amount two interlocks will be misaligned is equal to 0.0000067 × the distance between the locks × the temperature difference between the mating plates. Therefore, it is important to take into consideration how far apart you mount conical interlocks, and what the expected temperature difference might be between the two halves of the mold.

To show you how important this is, let me give you a scary example. Figure 2 shows a tapered interlock that has shifted just 0.0005 in. due to a difference in plate temperatures. Theoretically, this very slight shift causes an interlock with a 10° taper to separate at the parting line by about 0.0034 in. That's certainly more than the depth of any cavity vent.



A 10° tapered interlock offset by 0.0005 in.

Table 2 shows that interlocks don't have to be very far apart, and the temperature differential doesn't have to be that great, to get more than this 0.0005 in. of thermal expansion. Fortunately, these are theoretical values. In the real world, the female half will expand, the male half will compress, and the pockets in the plates will "give." But it takes clamp tonnage to do that. The greater the amount of thermal expansion, the greater the amount of tonnage required to overcome it. When a mold is flashing, but it blued off fine on the bench, thermal expansion could be the root cause of the problem.

TABLE 2 Thermal Expansion, in.

		Temperature Differential, F			
		5°	10°	15°	20°
Distance Apart	4 in.	0.0001	0.0003	0.0004	0.0005
	8 in.	0.0003	0.0005	0.0008	0.0011
	12 in.	0.0004	0.0008	0.0012	0.0016
	16 in.	0.0005	0.0011	0.0016	0.0021
	20 in.	0.0007	0.0013	0.0020	0.0027

In contrast, if a mold does not have a thermal expansion issue—meaning both halves of the mold are the same temperature—regardless of what the ambient temperature is, the farther the interlocks are spaced apart from each other, the more accurate the alignment will be.

MOLD DESIGN

The female half of an interlock should always be mounted on the hotter side of the mold, and the male half on the cooler side. Due to hot runners, hot bushings and part-sticking problems, the hotter side of the mold is typically the injection side. If the male half gets signifi-►

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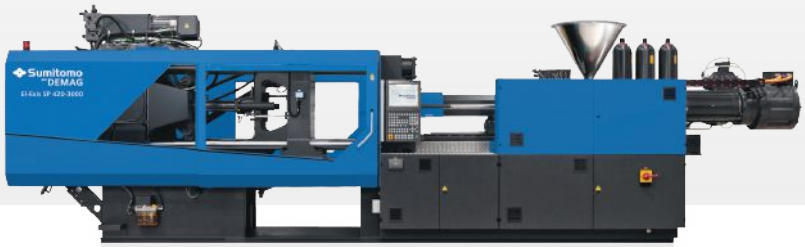

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cantly warmer than the female half, the fitted height increases, as does the rate of wear and the force required to close the mold.

Since interlocks are tightly fitted into the mold, an easy method of removal should always be considered. This usually isn't a problem with off-the-shelf interlocks, but if you are making your own, pry slots, jack-screw holes, punch-pin holes, or through pockets are required.

Over time, interlocks may enlarge their bore or pocket due to heavy side loads. Some mold-makers grind the outside diameter of conical interlocks or the sides of rectangular interlocks by 0.005 to 0.010 in. during the initial installation. If a bore or pocket elongates, it can be skim-cut, or re-faced, and a new set of interlocks can be installed without concern about them being loose. This is a good insurance policy if you don't have the room available to go to the next larger size.

FIG 3

Top photo shows the correct direction to install a rectangular interlock. Bottom image shows the incorrect direction.

One advantage of conical interlocks is that they are relatively easy and inexpensive to install. Preferably, they should be installed by line boring or partial line boring by clamping two or more plates together. Blind boring both halves of a conical interlock should be avoided, as they are the most difficult to align. In very thick plates, it is better to line bore the holes and add a hardened spacer behind the lock to achieve the necessary length.

A few mold-component suppliers offer both male and female conical interlocks with a counterbore on the front face. This allows for "face-mounting," or installation from the parting line. The advantage of this method of installation is that it frees up room underneath the interlock for water lines or other mold components.

Some suppliers offer cylindrical interlocks with rectangular mating faces, as opposed to a conical mating face. These hybrid interlocks are easy to install and provide the same benefits that rectangular locks do, but they have to be precisely keyed to prevent any radial misalignment.

Speaking of unique designs, an old friend recently told me about one of his molds not having room to install any interlocks. So he made custom leader pins that looked like step pins, but instead of the 90° sharp inside corner at the step, there was a 10° per side transition from the small diameter to the large diameter. The leader pins mated with custom bushings that had a 10° conical seat. He got his alignment despite the lack of real estate in the mold.

LOCATION

Rectangular interlocks should be installed perpendicular to the sides of the mold, preferably on the centerlines, forming a "plus sign" configuration. They should never be installed parallel to the sides of the mold, as shown in Fig. 3. Although this recommended design takes up quite a bit of valuable space, it provides trouble-free alignment regardless of how much thermal expansion there might be.

Why should rectangular interlocks be installed on the centerline of the mold? When they're installed on the centerline, it doesn't matter if the entire mold expands or just one half of the mold expands. The interlocks will allow them to expand and still keep them aligned. If you were to install the interlocks off-center, when one half of the mold expands more than the other, the interlocks won't line up and there will be a problem. This is not to say that it's mandatory to install rectangular interlocks on the centerlines of a mold. Quite often, an eyebolt hole or a water line is in the way. Just keep in mind that the farther they are installed from the center, the greater the risk of an issue with differential expansion.

All interlocks function best if they are mounted directly in the cavity and core inserts, rather than in the plates. Cavity and core pockets are usually relieved and sometimes there is not a lot of bearing surface. The inserts may be allowed to "float" a little, even though the plates are aligned. When interlocks are installed in the inserts, their alignment is guaranteed. If you can't install them in both the cavity and core inserts, installing one in a plate and the other in an insert is better than both in the plates.

If a part has an opening or window in it, a male conical interlock can be mounted in the shutoff opening on the top of the core, and a female interlock in the bottom of the cavity. This method of interlocking works extremely well at preventing core shift.

Interlocks mounted between a stripper plate and a core plate work well at protecting the angled shutoffs. As long as the taper of the interlock is less than the taper of the stripper-plate shutoff, the interlocks will engage before the stripper-plate shutoffs do.

In next month's column I'll get into tapered interlocks in even more detail. PT

ABOUT THE AUTHOR: Jim Fattori is a third-generation injection molder with more than 40 years of molding experience. He is the founder of Injection Mold Consulting LLC, and is also a project engineer for a large, multi-plant molder in New Jersey. Contact *jim@injectionmoldconsulting.com*; *injectionmoldconsulting.com*.

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Resins & Additives for Sustainability in Cars, Electronics & Packaging

Material suppliers are committed to the 'Circular Economy,' as evidenced by their adoption of new technologies, product introductions and collaborations.

SABIC will encourage sustainability with bio-renewable and recycled feedstocks and designing lightweight packaging.

The "Circular Economy" will be the dominant theme at the K 2019 show, Oct. 16-23, in Düsseldorf, Germany. Leading suppliers of materials and additives have all upped their focus on sustainability, evidenced by their adoption of a variety of new technologies—including new product formulations that lead to circular solutions (i.e., recycling) and reduce plastic waste. It underscores their commitment to the U.N.'s Sustainable Development Goals to address pressing issues—including energy and greenhouse-gas reduction, solutions to environmental degradation, water conservation, and material efficiency.

By Lilli Manolis Sherman
Senior Editor

Actions undertaken by materials suppliers include chemical recycling, advanced mechanical recycling, incorporation of biobased feedstocks, recycle-content resins with performance equivalent to their virgin counterparts, as well as plastic formulations that are easier to recycle and/or are lighter in weight yet offer optimal performance, ranging from packaging to automotive and electronic parts.

Borealis is now owner of two recycling companies.

Consistent with the "circular" theme, additives suppliers are addressing sustainability with colorants and additives that are more environmentally friendly or have bio content, allow for easier recyclability, and reduce material waste.

Visitors can expect to see new engineered thermoplastics that meet key trends in automotive—including electrification of vehicles and automated driving—plus E&E, packaging, and healthcare.

MATERIALS SUPPLIERS PARTNER UP

Industry partnerships characterize several efforts being undertaken by materials suppliers. Recently reported industry collaborations include LyondellBasell and Neste, a producer of renewable hydrocarbons, which announced the first parallel production of bio-based PP and LDPE at a commercial scale. Also, Dow and BioLogiQ are evaluating potential synergies between the latter's NuPlastiQ plant-based biopolymer and Dow's PE resins.

SABIC will address using bio-renewable and recycled feedstocks and designing lightweight packaging to extend shelf life of food, as well as solutions for reuse and recycling of industrial packaging through innovative processes and partner collaborations

The company is reportedly first in the industry to scale up a chemical recycling process for transforming mixed plastic waste back to new polymers, enabling downstream customers to develop high-quality, recyclable product designs.

New solutions from SABIC for lightweighting are the Cohers S ethylene-octene plastomer for film to enhance heat sealing, clarity, toughness and elasticity; and PP-UMS (ultra-melt-strength) to trim weight through foaming in automotive, packaging and building/construction.

Borealis is now owner of two recycling companies: mtm, a German recycler of rigid packaging, produces PCR-PP & PE for injection molding (e.g., paint pails—100% rPP and caps for non-food use—25% rPP); and Ecoplast, Austrian recycler of flexible package for reuse in film (e.g., 100% PCR trash liner). The company will showcase its Borcycle recycling process, jointly developed with recycling machinery maker Erema. It is said to optimize each step in the recycling process to produce higher quality recycle.

Through mtm, new and improved recycled products will be highlighted by Borealis, including Borcycle MF1981SY, 80+% rPP plus 10% talc and Borealis Queo metallocene low-density PE plastomer (octene copolymer) as an impact modifier. This the first of a range of rPP grades that boast a good stiffness/toughness balance and are targeted for use in visible black parts, such as small appliances.

The company will also show significant improvements to existing recycled Purpolen polyolefin grades, also made by mtm, including PP Y40, an rPP with improved flow—raised to 40 g/10 min for injection molding thin-wall parts with long flow paths for pails, thick-wall packaging and appliance parts. PE FF is a fine-filtered PE (0.950 density) that boasts reduced gel level and quality comparable to virgin for general-purpose applications. And PE Y01 is 100% PCR with low MFR and low gels for extrusion of pipe or blowing large bottles.

Nova Chemicals will highlight six new virgin PE grades (LL and MD) capable of accepting 20% or more recycle and also said to be themselves "more friendly to recycling."

Ineos Styrolution is exploring various avenues to achieving circular styrenics solutions. These include PS chemical-recycling technology and the launch of new recycle-content PS grades.

Ascend Performance Materials will discuss new customized recycle-content nylon 66 to meet increasing demand.

Clariant is expanding its EcoTain label to include EcoTain Partnerships between at least three partners in the value chain to foster sustainability improvements.

BASF will highlight its certified-compostable ecovio resins, which now comprise a portfolio for applications from mulch films to fruit and vegetable bags and organic waste bags, which can be used throughout the entire food cycle.

Other engineering thermoplastic suppliers, like Lanxess,

Covestro sees its PC resins and blends as materials of choice for 5G technology and will show a series of 5G antenna prototypes at the show.

Covestro and Solvay are all working toward establishing closed-loop material cycles in the manufacture and application of their materials. A number of pilot projects are underway with customers and other industry partners.

ADDITIVES SUPPLIERS GOING GREEN

Similar actions are taking place in additives. Milliken's Plastics Additives group will highlight its partnership with Chicago-based PureCycle Technologies to advance closed-loop recycling of PP. Using technology developed and licensed by Procter & Gamble Co., PureCycle plans to open in Ohio by 2021 its first plant employing a patented recycling method that restores virgin-like quality to waste PP.

Clariant is expanding its EcoTain label, currently awarded to more than 200 products that show outstanding sustainability advantages, to include EcoTain Partnerships that will foster collaboration between at least three partners in the value chain to create concrete sustainability and business impacts and advance environmental protection and the circular economy. At K 2019, Clariant will issue an open invitation to companies to come together and collaborate on one particularly challenging aspect of recycling.

BASF will highlight UV stabilizers and pigments that perfom well in recycled plastics and/or sorting of recycled plastics.

Songwon will show how technological expertise enables development of materials that can help customers tackle a wide variety of environmental issues, including stabilizers that make plastics more durable, allowing easier recyclability and reducing waste.

MATERIALS GALORE FOR AUTOMOTIVE

BASF will launch Ultramid Advanced T2000, the latest addition to its PPA portfolio. Based on nylon 6T/66, it is said to combine excellent mechanical and dielectric strengths at high temperatures, a combination particularly crucial for E&E connectors. This PPA reportedly shows improved impact strength on par with standard nylon 66 and lower water uptake than standard aliphatic nylons. Comprising about 10 grades, T2000 is also a versatile candidate for automotive metal replacement such as water-outlet valves, water pumps, fuel-system components, actuators, transmission sensors and clutch parts.

Covestro will present a new interior concept for the "future car," which it says will be a multifunctional, mobile living and working space. Covestro will highlight "smart materials" for new interiors, including new Makrolon PC grades and blends said to enable a range of glass-like surfaces and functional colors, critical for integration of innovative displays, sensors, cameras and ambient lighting systems.

Covestro will also showcase Makrolon PC films for printed 3D, large-scale cover plates for integrated displays. The films also serve as carriers for printed electronics in touchscreens for cars, whose use will increase drastically, Covestro says, with increasing digitalization and networking, as well as the trend towards autonomous driving. Seamless integration of displays is also supported by the firm's new generation of Makrolon AI PC materials.

PC resins and blends are also candidates for 5G technology. Covestro will show a series of 5G antenna prototypes for small cells in the frequency range of 3.5 GHz and 28 GHz. Covestro will also show new films for 5G smartphones. A Makrofol SR PC/PMMA multilayer film (with acrylic as the outside layer) combined with a new manufacturing process results in cellphone back covers that look like glass but are not fragile. This crystal-clear, 3D-formable and 5G-compatible film meets requirements for transmission at high radio frequencies with wavelengths in the millimeter range and is engineered for optimal design freedom to create fashionable mobile phones with decoration technologies such as UV patterning and non-conductive vacuum metalization.

PC resins and blends are potential materials of choice for 5G technology.

Lanxess' High Performance Materials (HPM) business unit will launch a range of materials for electric mobility. The use of the color orange to identify live, plastic-sheathed components is becoming well-established in electric vehicles, but it is a challenge to develop orange compounds that exhibit high color stability over the long term. New HPM nylon 6 and PBT compounds for high-voltage applications will be colored in the ►

Milliken presents

Millad® NX® 8000 clarifier for PP helps processors & brand owners on the path to better sustainability

At the K 2019 trade fair on Oct. 16-23 in Düsseldorf, Germany, Milliken Chemical will clearly demonstrate how it is **"Enhancing plastics with Color, Care, Clarity and Performance. Together."**

Its Millad® NX® 8000 clarifier for polypropylene (PP) — a key component in nearly 80 percent of the world's clear PP today —is helping that cause. It not only transforms the resulting polypropylene, NX® UltraClear™ PP, into a lightweight, crystal-clear replacement for alternative materials, but also reduces processor cycle times and contributes to lowering related greenhouse gas (GHG) emissions and improving its environmental performance in injection molded products.

UL Environment, a business unit of UL (Underwriters Laboratories), has documented that use of Millad NX 8000 clarifier can result in significant energy savings when injection molding transparent PP products. Numerous industrial trials indicate that use of this highly soluble clarifier can lower processing temperatures from 235°C to 190°C (455°F to 374°F), compared with third-generation clarifiers that require high temperatures to achieve the desired transparency. UL has shown that these lower temperatures result in the energy savings of between 8 and 12%, while also reducing associated CO_2 emissions.

This independent, third-party certification means that those using NX UltraClear PP can add the UL Environmental Claim Validation (ECV) label to their products. This provides an obvious marketing advantage to those aiming to demonstrate their commitment to a more circular economy. But, just as importantly, the eco-label helps to confirm to all involved that they have made the more sustainable choice when it comes to doing the right thing for the planet.

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highly vivid RAL 2003 (Lanxess color code 200849) tone. Another color variant is almost ready to be introduced.

Among the first to feature this new orange color are the glass-reinforced, halogen-free flame-retardant nylon 6 compounds Durethan BKV20FN01, BKV30FN04 and BKV45FN04. The latter meets UL 94V-0 at thickness of 0.4 mm. Also new is the hydrolysis-stabilized, glass-reinforced PBT Pocan BF4232HR. Colored orange, it also achieves 94V-0 classification at 0.4 mm. Other new HPM products prevent electrical corrosion upon contact with live metal parts; and there are halogen-free, flame-retardant materials for battery cell holders and cover plates.

In lightweight design, Lanxess is working primarily on thermoplastic composites based on its Tepex prepregs. At K, look for a seat shell and highly integrated front-end carrier, both said to exhibit excellent crash resistance.

Also new from Lanxess are nylon and PBT compounds for cost-effective blow molding of components for air management in turbocharged combustion engines and/or liners for vehicles powered by hydrogen and natural gas.

Ascend Performance Materials will highlight several new Vydyne nylon 66 grades, including high-temperature nylons for automotive; the company's first long-chain nylon 66 grades for extruded fuel and brake lines; and flame-retardant grades for electrical applications.

Borealis will feature new grades of Fibremod Carbon compounds for automotive, including CG210SY with 20% carbon fiber in PP, boasting improved surface and dimensional stability. also new is CD211SY, a high-flow "hybrid" of 10% carbon fiber, 10% talc in PP.

SABIC has been working with leading automotive OEMs toward development of "breakthrough" plastic and metal-replacement solutions. At K 2019, SABIC will feature new concepts for vehicle electrification involving conductive PC and PP.

INEOS Styrolution will unveil an expanded line of StyLight styrenic copolymer composites for automotive, ranging from seat structures, door carriers, and front-end modules to body panels and exterior and interior parts with a carbon-fiber look. Also new is a high-flow ABS for auto interior and exterior parts, electronic housings, and medical devices like inhalers.

SABIC will feature new product concepts for vehicle electrification, such as conductive PC and PP solutions.

Polyplastics will showcase new Duracon polyacetals (POM) for automotive, including grades for injection molded fuel-system components. Also new is a high-flow/high-rigidity acetal with MFR around 14, suited to wide range of molding conditions.

Lanxess will spotlight new mobility concepts, including this steering-column switch made of a new nylon 6.

Yet another new grade is said to combine high strength with good creep and sliding properties.

New from Polyplastics for electric vehicles are Durafide PPS and Duranex PBT targeted for peripheral engine parts such as power-control units to deliver high insulating properties, reduce water absorption, and meet harsh operating conditions. ►

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Kraiburg TPE will unveil new compounds with optimized odor and emission behavior for auto interiors and consumer products, and TPEs with enhanced UV resistance and adhesion to plastics like ASA and PMMA for auto exteriors. Also on tap at K will be custom-engineered thermoplastic hybrids (TEHs) that provide superior chemical and thermal resistance.

DSM, active in additive manufacturing (AM) for over 25 years, will outline opportunities for AM at automotive OEMs—from producing vehicles in low volumes to incorporating individual customer requirements and tastes, and also production of spare parts. The latter is an area with huge potential, as it could help reduce inventory, typically at least 7% of an automotive OEM's liquid assets, and also result in cost-cutting and carbon-footprint reduction.

DSM will be outlining additive manufacturing opportunities for automotive and sees huge potential in production of spare parts.

MATERIALS FOR PACKAGING, INDUSTRIAL & MORE

BASF has extended its Ultradur PBT portfolio with what is said to be the first PBT for extrusion, B6551 LNI; and the first for thermoforming, B6560 M2 FC TF. Up to now the melt strength of PBT was not sufficient to make it a preferred product for extrusion. By connecting and branching the polymer chains via tailor-made additives, BASF gained very high melt strength. This reportedly makes B6551 LNI well suited for pipes, profiles and mandrels. And B6560 M2 FC TF competes for extrusion of films and thermoforming of packaging or technical parts.

Kraiburg TPE will launch two custom-engineered compound series with significantly better migration control than common TPEs. They are particularly suited for closure systems, valves and seals for packaging with direct contact to foods that contain fat.

Wacker will be presenting its new Elastosil LR 5040 liquid silicone rubber (LSR) series. Even without post-cure, this LSR shows excellent mechanical properties and meets strict regulatory requirements for sensitive applications in the baby care, food and medical technology. Wacker will present a live injection molding demo with the new LR5040 on a KraussMaffei machine.

Solvay will show its new thermoplastic composites for aerospace, automotive, and oil and gas. Beyond lightweighting, these materials reportedly feature exceptional heat and shock resistance, strength, toughness and chemical inertness.

Also new from Solvay is reportedly an industry-first high-temperature PEEK. Also showcased will be unique applications ►

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of the company's long-fiber thermoplastic (LFT) materials, such as the world's first all-polymer recyclable e-bike.

Evonik Industries, which this year marked the 40th anniversary of its Vestamid nylon 12 elastomer (PEBA), will introduce a new member of the product line that is already popular in the athletic-equipment industry. It boasts transparency and gloss levels that give designers far more freedom than they have ever had with PEBA.

NOVEL ADDITIVES, PIGMENTS, COLORANTS

Solvay is launching Alve-One foaming solutions, an innovative generation of high-performance and cost-effective chemical blowing agents based on "100% safe" ingredients for a range of resins, including PVC, EVA and polyolefins. These formulations reportedly have no negative impact on human respiratory health and are safe for workers to handle without compromising efficiency and performance in plastic foaming.

Milliken's HPN 715 is said to offer new opportunities for PP to replace more expensive engineering resins in demanding applications.

A next-generation Tinuvin NOR HALS light and heat stabilizer will be highlighted by BASF. The company will also unveil new pigments, including two new Lumina Royal effect pigments: Russet enables new vibrant, high-chroma red shades and provides greater formulation flexibility; and Amber, which promises strong sparkle for attractive bronze, orange, golden and red effect shades.

Also new from BASF, Microlen Piano Black is said to enable the deepest and most enduring black and outstanding dispersion for high-end plastic design. And there are new black and red pigments recommended for recycling and other demanding applications. Due to its high heat and chemical stability, Sicopal Red K 3050 FK reportedly stands up to the most demanding applications, including engineering plastics. Building on the Sicopal Black technology, this new addition boasts best-in-class near-infrared (NIR) reflective properties, and addresses the current industry need for recyclable black plastics that can pass through infrared sorting at materials recycling facilities.

Tolsa's expanded range of Adins flame-retardant additives includes a new grade that uses TiO_2 to boost performance of intumescent systems for PP.

Lanxess' Inorganic Pigments business will present a black pigment that reflects the infrared portion of sunlight 20% more effectively than conventional black pigments. Plastic roofs and facades offer a wealth of potential for use in reducing temperatures inside buildings.

With a partner that makes NIR scanners , Clariant developed new black colorants that can be identified by NIR sorting devices. These blacks can be used for various polymers and applications, such as packaging and E&E.

Also notable from Clariant are pigments designed for coloring biodegradable plastics, and new halogen-free flame retardants that retain performance after the material is recycled.

Clariant will also launch a new patented oxygen-scavenger masterbatch for PET in food and beverage packaging. It is reportedly based on a new molecule that goes beyond existing solutions for PET in protecting content shelf life and taste.

Clariant developed new black colorants that can be identified by NIR sorting devices.

Songwon is making its entry into the flame-retardant arena with synergists that reportedly can reduce flame-retardant loadings in both halogen and non-halogen formulations.

Milliken will be launching a new Hyperform HPN nucleating agent. HPN 715 is said to offer new opportunities for PP to replace more expensive engineering resins in demanding applications. It boasts an optimized balance of various key factors, while also providing higher HDT. This allows PP to be used in microwaveable containers, vehicle under-hood components and household appliances.

Perstorp will showcase its new Pevalen Pro, a renewable polyol-ester, non-phthalate plasticizer for producing flexible PVC with a lower carbon footprint. Second-generation Pevalen Pro allows for up to 40% renewable content in flexible PVC and is a direct replacement for standard Pevalen with no compromise in quality and performance, making it very easy to switch, the company says.

Tolsa will showcase new Adins flame-retardant additives, such as Adins Clay synergists that reduce smoke production and improve heat release with halogen and halogen-free flame-retardant systems.

Tolsa also has a new grade that uses TiO_2 to improve the performance of intumescent systems for PP and coatings. It further stabilizes the char at dosages of around 1-2%. Key applications include transportation, pipe, coatings, and wire and cable. Another new grade is Adins Clay Sil1 for PVC and silicone formulations, said to deliver reduced heat release and smoke suppression. It serves as an alternative to antimony trioxide. PT

Injection Molding Goes for the 'Green'

'Circular Economy' joins Industry 4.0 as common themes of injection molding exhibits in Düsseldorf.

How does injection molding relate to plastics recycling and reuse? K 2019 will provide some answers.

By Matthew Naitove
Executive Editor

If you attended a major international plastics trade show in recent years, you were likely bombarded with messages that the future of plastics processing is "digitalization," also known as Industry 4.0. That theme will continue in force at October's K 2019 show, where numerous exhibitors will present their latest features and products for "smart machines, smart processes and smart service."

But another overarching theme will claim pride of place at this year's event—"Circular Economy," which refers to the whole range of strategies for recycling and reuse of plastics waste, as well as design for recyclability. While this will be one of the dominant notes sounded at the show, other elements of sustainability, such as energy savings and lightweighting of plastics parts, will be heard frequently as well.

RECYCLING VIA INJECTION MOLDING

How does injection molding relate to the Circular Economy? A number of exhibitors will propose answers:

- Because variation in melt viscosity is one of the major challenges to molders of recycled plastics, Engel will show how its iQ weight control software can automatically adjust for such variances "on the fly" to maintain consistent shot weight. "Intelligent assistance opens the door for recycled materials to a far broader range of applications," says Günther Klammer, the head of Engel's Plasticizing Systems div. This capability will be demonstrated in molding a ruler from 100% recycled ABS. Molding will switch between two hoppers containing recycled material from two different suppliers, one with 21 MFI and the other 31 MFI.

Improving technology for using recycled materials brings injection molding into the "Circular Economy."

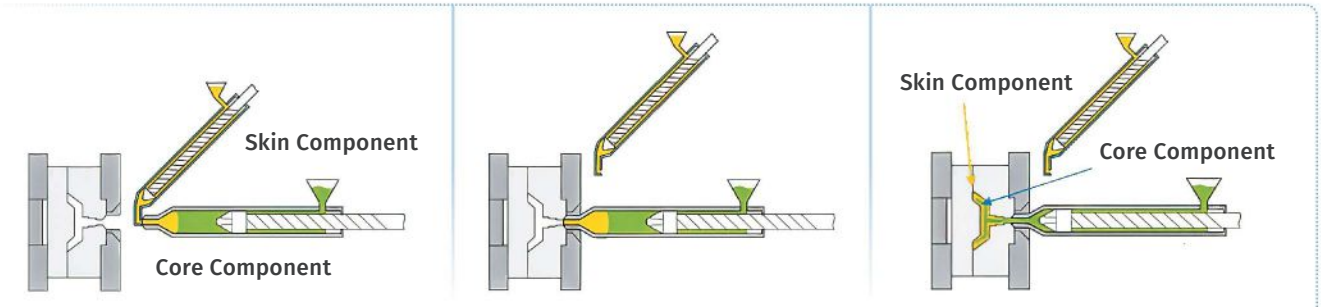
- A version of this strategy will be demonstrated by Wittmann Battenfeld, using its HiQ-Flow software to compensate for material viscosity variations while molding parts containing reground sprues and parts coming from a new Wittmann G-Max 9 granulator beside the press, via vacuum conveying back to the feed hopper.

- KraussMaffei plans to exhibit a complete Circular Economy cycle by molding PP buckets, which will then be shredded and some of the regrind will be reintroduced into molding fresh buckets. Remaining regrind will be com-

pounded with pigments and 20% talc in a KM (formerly Berstorff) ZE 28 twin-screw extruder. Those pellets will be used to backmold a fabric covering for an automotive A-pillar in a second KM injection machine. KM's APC Plus control software will automatically adjust for viscosity variations by adjusting the injection switchover point and the holding-pressure level from shot to shot in order to maintain uniform shot weight. A new feature is monitoring the residence time of the melt in the barrel to ensure consistent quality.

Injection molding liquid metal continues to advance; see it combined with LSR in two-component molding.

• One way of reusing scrap or recycled plastics is to bury them in the middle layer of a co-injected sandwich structure. Engel is calling its newly enhanced process for this "skinmelt" and claims it can achieve a recycled content over 50%. Engel will mold crates with >50% post-consumer PP during the show. Engel says this is a particular challenge due to the complex geometry of the part. Although sandwich molding is not a new concept, Engel claims to have achieved faster cycles and has developed a new control for the process that allows flexibility to vary the core/skin ratio.



Engel's new skinmelt co-injection sequence: Left—loading the skin material into the barrel with core material. Center—starting injection, with skin material entering the mold first. Right—holding pressure after filling.

Unlike "classic" co-injection, the skinmelt process involves accumulating both virgin skin and recycled core melts in one barrel prior to injection. Engel says this avoids the difficulties of controlling and coordinating injection by both barrels simultaneously. Engel uses the main injector for the core material and the second barrel—angled upward over the first—for the skin. The skin material is extruded into the main barrel, in front of the shot of core material, and then a valve closes to shut off the second (skin) barrel from the main (core) barrel. The skin material is the first to enter the mold cavity, pushed forward and against the cavity walls by the core material. Animation of the entire process is displayed on the CC300 control screen.

• In addition, Engel will backmold decorative auto interior components with recycle that is foamed with nitrogen injection. Engel will also be molding post-consumer plastics into miniature waste containers in the outdoor exhibition area between Halls 10 and 16. Another outdoor exhibit nearby will be the pavilion of recycling machinery supplier Erema. There, an Engel machine will mold card boxes from recycled nylon fishnets. These nets have commonly been discarded into the sea, where they are a major hazard to marine life. The reprocessed fishnet material at the K show come from Chile, where three U.S. machine manufacturers have set up collection points for used fishnets. In Chile, the nets are recycled on an Erema system and molded into skateboards and sunglasses on Engel injection presses.

• Arburg will present two examples of Circular Economy as part of its new "arburgGREENworld" program. Around 30% recycled PP (from Erema) will be used to mold eight cups in about 4 sec on a brand-new hybrid Allrounder 1020 H (600 metric tons) in a "Packaging" version (see below). The second example will utilize Arburg's relatively new Profoam physical foaming process to mold a machine door handle in a two-component press with foamed PCR from household waste and partial overmolding with TPE.

Few details were available on the arburgGREENworld program before the show, but the company says it rests on three pillars named analogously to those in its "arburgXworld" digitalization strategy: Green Machine, Green Production and Green Services. A fourth pillar, Green Environment, includes sustainability in Arburg's internal production processes.

• Boy Machines will run five different applications of biobased and recycled materials at its booth.

• Nissei Plastic Industrial Co. is improving technology for molding biobased, biodegradable and compostable polymers that presumably won't contribute to the plastics waste problem in oceans and elsewhere. Nissei is focusing on the best known and most widely ►

available biopolymer, polylactic acid (PLA). According to the company, PLA has seen limited use in injection molding because of its poor suitability for deep-draw, thin-wall parts and tendency to short shots in consequence of PLA's poor flow and mold release.

At K, Nissei will demonstrate practical thin-wall molding technology for 100% PLA, using champagne glasses as an example. To overcome poor flow, Nissei came up with a new method of mixing supercritical carbon dioxide into molten PLA. It reportedly enables thinwall molding at unprecedented levels (0.65 mm) while achieving super-high transparency.

• Wilmington Machinery will discuss a new version (see below) of its MP 800 (800-ton) medium-pressure machine with a 30:1 L/D injection barrel capable of a 50-lb shot. It has a recently developed screw with dual mixing sections, which can perform inline compounding with recycled or virgin materials.

NEW & UPDATED MACHINES

Major hardware developments seem to be less of an emphasis at this show than new control features, services and innovative applications (see next section). But there will be some new introductions, such as these:

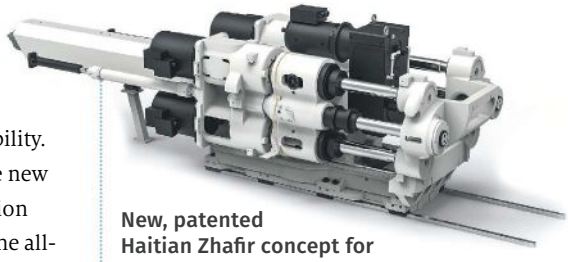
• Arburg will bring out an additional size in its new-generation "H" series of hybrid machines. The Allrounder 1020 H has a 600-m.t. clamp, tiebar spacing of 1020 mm, and a new size 7000 injection unit (4.2 kg PS shot capacity), which is also available for the 650-m.t. Allrounder 1120 H, Arburg's largest machine.

Compact cell pairs Engel's new victory 120 AMM machine for amorphous-metal molding with a second, vertical press for overmolding an LSR seal, using robotic transfer between the two.

• Engel will show off a new machine for injection molding liquid amorphous metals ("metallic glasses"). The Heraeus Amloy zirconium-based and copper-based alloys boast a combination of high hardness, strength and elasticity (toughness) not matched by conventional metals and allowing for molding thin-wall parts. Excellent corrosion resistance and surface quality are also claimed. The new victory120 AMM (amorphous metal molding) press is based on a hydraulic victory tiebarless machine with injection speed of 1000 mm/sec standard. It's said to achieve cycle times up to 70% shorter than previously possible for injection molding amorphous metals. High productivity helps offset the high cost of the amorphous metal, Engel says. Another new advantage is that molders need no license to practice the technology.

At the show, Engel will present what it says is a first—overmolding amorphous metal with LSR in a fully automated molding cell. After molding the metal substrate, the demo electrical part will be demolded by an Engel viper robot, and then an easix six-axis robot will place the part in a vertical Engel insert molding press with a rotary table for overmolding the LSR seal.

• Haitian International will present the third generation of three more machine lines, following the introduction of the Jupiter III earlier this year (see April Keeping Up). The upgraded models boast improved efficiency and productivity. Optimized drives and an open integration strategy for robotics and automation add flexibility.



New, patented Haitian Zhafir concept for large electric injection units, with four spindles and four motors.

One of the new third-generation machines is the all-electric Zhafir Venus III, to be shown in a medical application. It comes with the brand-new, patented Zhafir electric injection unit with significantly increased injection-pressure capability. Said to be attractively priced, it's available with one, two or four spindles. An optimized toggle design is another feature of the Venus III, which boasts up to 70% energy savings.

Third-generation technology will also be shown in the Zhafir Zeres F Series, which adds an integrated hydraulic drive for core pulls and ejectors to the electric Venus design.

A new version of "the world's best-selling injection machine" will be presented as an economical solution for consumer goods in an insert-molding cell with a Hilectro robot from Haitian Drive Systems. The servohydraulic Mars III has a new overall design, new motors, and other improvements analogous to those of the servohydraulic, two-platen Jupiter III Series. A Jupiter III will also run at the show in an automotive application.

• KraussMaffei is launching a larger size in its servohydraulic, two-platen series, the GX 1100 (1100 m.t.). It will mold two PP buckets of 20 L each with IML. Shot weight is about 1.5 kg and cycle time is just 14 sec. The "speed" option for this machine ensures fast injection (up to 700 mm/sec) and rapid clamp motion for molding large packaging with mold-opening distances of more than 350 mm. Dry-cycle time is almost half a second shorter. It also will use an HPS barrier screw for polyolefins (26:1 L/D), said to provide ►

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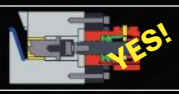
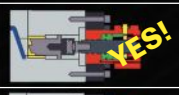
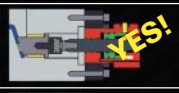
	Mold OPEN Core Out	
	Mold CLOSED Core OUT	CAN'T DO IT!
	Mold CLOSED Core IN	
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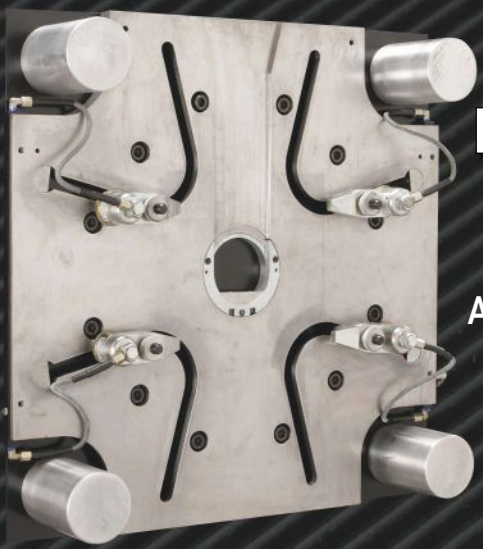

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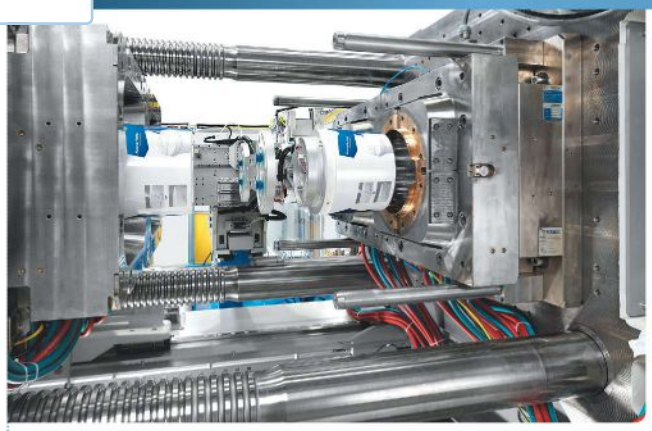

KraussMaffei will debut a larger size in its GX servohydraulic two-platen line. This GX-1100 will mold two 20L PP buckets with IML in just 14 sec. This is also the first KM machine to integrate Netstal's Smart Operation control option.

more than 40% higher throughput than standard KM screws.

In addition, this GX 1100 is the first KM machine equipped with the Smart Operation control option adopted from the Netstal brand, which was recently integrated into KraussMaffei. This option creates separate control environments for setup, which requires maximum flexibility, and production, which requires intuitive and safe machine operation. Guided use of the production screens uses new Smart Buttons and a configurable dashboard. The latter shows machine status, selected process info, and application-specific work instructions, while all other control elements are locked. Smart Buttons actuate automatic startup and shutdown sequences, including automated purge. Another button initiates a single-shot cycle at the start of a run. And one button launches continuous cycling. Safety features include the need to press start and stop buttons three times in a row, and to hold down a button continuously to move the injection carriage forward.

Milacron aims to attract attention with its new Cincinnati large servohydraulic two-platen presses (above) and new Q-Series servohydraulic toggles (below).

• Milacron will show off its new "global" Q-Series of servohydraulic toggles, introduced in the U.S. early this year. The new line of 55 to 610 tons is based partly on the former Ferromatik F-Series from Germany. Milacron will also show its new Cincinnati line of large servohydraulic two-platen machines, of which a 2250-tonner was shown at NPE2018.

• Negri Bossi will introduced a 600-m.t. size that completes its new Nova sT line of servohydraulic machines from 600 to 1300 m.t. They have a new toggle system that's said to be so compact as to come close to the footprint of a two-platen clamp. Also shown will be two models of the new Nova eT all-electric range, shown at NPE2018.

• Sumitomo (SHI) Demag will display two updated machines in the El-Exis SP high-speed hybrid series for packaging; they consume up to 20% less energy than their predecessors, thanks to a new control valve that regulates hydraulic pressure during loading of the accumulator. These machines have injection speeds up to 1000 mm/sec. One of the two presses will run a 72-cavity mold to produce 130,000 water-bottle caps/hr.

Also new is a larger model in the IntElect all-electric series. The IntElect 500 is a step up from the previous 460-m.t. largest size. It offers larger tiebar spacing, mold height and opening stroke, suiting it to automotive applications that would previously have required a larger tonnage.

Sumitomo (SHI) Demag has cut energy consumption of its hybrid El-Exis SP packaging machine by up to 20%, while it can still mold water-bottle caps in 72 cavities at 130,000/hr.

The newest size of IntElect S medical machine, 180 m.t., is said to be GMP-compliant and cleanroom-ready, with a mold-area layout that ensures freedom from contaminants, particles and lubricants. With a dry-cycle time of 1.2 sec, the "S" model outperforms previous generations of IntElect machines. Its extended tiebar spacing and mold height means that multicavity molds can be used with small injection units, especially beneficial to precision medical molders. It's built for very tight-tolerance applications with cycle times of 3 to 10 sec.

And for converting standard machines to multicomponent molding, Sumitomo Demag will unveil its eMultiPlug line of auxiliary injection units, which use the same servo drive as the IntElect machine.

• Toshiba is displaying a 50-ton model from its new ECSXIII all-electric series, shown at NPE2018. This machine is outfitted for LSR, but the integration of cold-runner control with the machine's enhanced V70 controller reportedly allows easy con-

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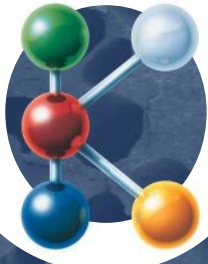

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version to thermoplastic hot-runner molding. The machine will be shown with one of Yushin's latest FRA linear robots, also introduced at NPE.

Wilmington will discuss its revised design of its MP800 medium-pressure press with inline reciprocating screw and plunger to provide FIFO melt handling.

• Wilmington Machinery has re-engineered its MP800 medium-pressure injection machine since it was presented at NPE2018. This 800-ton, servohydraulic press is aimed at both low-pressure structural foam and standard injection molding at pressures up to 10,000 psi. It has a 50-lb shot capacity and can mold parts measuring up to 72 × 48 in. It was originally designed as a two-stage machine with side-by-side fixed screw and plunger. The new single-stage version has a 130-mm (5.1-in.) diam. reciprocating screw and an inline plunger in front of the screw. Melt passes from the screw through a channel inside the plunger and exits via a ball-check valve at the front of the plunger. Because the plunger has twice the surface area of the screw, this unit can handle a larger shot than usual for a screw of that size. The main reason for the redesign is to provide first-in/first-out melt handling. This avoids exposing some of the melt to excessive residence time and heat history, which can lead to discoloration and degradation of resins and additives. According to Wilmington founder and president Russ La Belle, this inline screw/plunger concept dates back to the 1980s and has also been tested successfully on accumulator-head blow molding machines, which his firm also builds.

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The screw of the MP800 injection machine has 30:1 L/D and dual mixing sections, suiting it to compounding with recycled resins and additives or fiber reinforcements.

Wilmington will also be talking about two vertical-clamp structural-foam presses it built recently for a customer looking to save floor space, as well as the advantages of vertical presses in terms of easier mold setup and reduced tool costs. Each of these large servohydraulic presses has 125-lb shot capacity and can accept up to six molds to produce up to 20 parts per cycle. Each mold ►

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is filled independently by Wilmington's proprietary Versafil injection system, which sequences mold filling and provides individual shot control to each mold.

• Wittmann Battenfeld will bring its new 120-m.t. VPower vertical press, shown for the first time in a multicomponent version (see Sept. '18 Close Up). It will mold an automotive plug of nylon and TPE in a 2+2-cavity mold. The automation system will utilize a SCARA robot and WX142 linear robot to insert the wrap pins, transfer the nylon preforms to the overmold cavities, and demold parts.

Also new from Wittmann will be a high-speed, all-electric EcoPower Xpress 160 in a new medical version. A special screw and drying hopper are provided to mold PET blood tubes in 48 cavities.

NEW COMPONENTS, FEATURES, AUXILIARIES

A potentially exciting development from Arburg is the addition of mold-filling simulation to a machine controller. Integrating the new "filling assistant" (based on Simcon flow simulation) into the machine control means that the press "knows" the part it will produce. The simulation model created offline and the part geometry are read directly into the control system. Then, in operation, the degree of part filling, relative to the current screw position, is animated in real time as a 3D graphic. The machine operator can compare the results of the simulation created offline with the actual filling performance in the last cycle on the screen monitor. This will aid in optimization of the filling profile.

In recent months, the filling assistant's capability has been extended to cover a larger spectrum of molds and materials. This feature is available on Arburg's newest Gestica controller, which will be shown for the first time on an all-electric Allrounder 570 A (200 m.t.). Until now, the Gestica controller has been available only on the new-generation Allrounder H hybrid series of larger presses.

For "smart factories," new software monitors and analyzes complex processes and complete cells—presses, auxiliaries and automation.

Arburg will also show a new Freeformer model that is capable of 3D printing with fiber reinforcements.

Boy Machines hinted that it will present new plastication technology, called Servo-Plast, as well as a new alternative positioning for its LR 5 linear robot that will save floor space.

Engel will present two new special-purpose screws. The PFS (Physical Foaming Screw) was developed specifically for structural-foam molding with direct gas injection. It reportedly provides better homogenization of the gas-loaded melt and longer life with glass reinforcements. It will be demonstrated with the MuCell microcellular foam process at K.

The second new screw is the LFS (Long Fiber Screw), designed to meet increasing demand for long-glass PP and nylon in automotive applications. It is designed to optimize distribution of the fiber bundles while minimizing fiber breakage and screw wear. Engel's previous solution was a screw with a bolt-on mixing head for the long glass. The LFS is a one-piece design with a refined geometry.

Engel is also introducing three automation products. One is viper linear servo robots with longer takeoff strokes but the same payload capacities as before. For example, the viper 20 has its "X" stroke enlarged from 900 mm to 1100 mm. The X-stroke extension will be an option for viper models 12 to 60.

Engel says this enhancement was made possible by two "smart" inject 4.0 functions: iQ vibration control, which actively damps vibrations, and the new "multidynamic" function, which adjusts speeds of the robot's motions according to the payload. In other words, the robot automatically moves faster with lighter loads, slower with heavier ones. Both software features are now standard on viper robots.

Also new is a pneumatic sprue picker, Engel pic A, said to be both the longest-lasting and the most compact sprue picker on the market. Instead of the usual rigid X axis, the pic A has a swivel arm that moves within a very tight area. The takeoff stroke is continuously variable

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up to 400 mm. Also new is ability to adjust the Y axis in just a few steps; and the A axis rotation angle automatically adjusts between 0° and 90°. Ease of operation is said to be a particular benefit: When fully swiveled in, the pic A leaves the entire mold area free, facilitating mold changes. "The time-consuming process of swiveling out the sprue picker and setting the XY adjustment unit is history," Engel states.

Engel is also showing for the first time its "compact safety cell," described as a cost-effective, standardized solution for minimizing footprint and ensuring safe interaction between cell components. A medical cell will demonstrate this concept with parts handling and box changing—all significantly slimmer than standard safety guarding. When the cell is opened up, the box changer moves automatically to the side, giving open access to the mold. The standardized design can accommodate additional components, such as a multi-tiered conveyor belt or tray server, and enables fast changeovers, even in cleanroom environments.

Milacron will show off its pioneering position as the first machine builder to integrate the novel iMFLUX low-pressure injection process into its Mosaic machine controls, first introduced at last October's Fakuma 2018 show in Germany. This process is claimed to speed cycles while molding at lower pressures and providing more stress-free parts. (See feature article in this issue for more on iMFLUX.)

Trexel will show off two of its newest equipment developments for MuCell microcellular foaming: the P-Series gas-metering unit, its first for fast-cycling packaging applications (also shown at NPE2018); and the brand-new Tip Dosing Module (TDM), which eliminates the need for the previous special screw and barrel. TDM is retrofittable on standard screws, is gentler to fiber reinforcements, and boosts output (see June Keeping Up).

In robots, Sepro is highlighting its newest Cartesian model, the S5-25 Speed that's 50% faster than the standard S5-25. It reportedly can get in and out of the mold space in under 1 sec. Also on display are cobots from Universal Robots, which Sepro America is now offering with its Visual controls.

Wittmann Battenfeld will operate several of its new X-series linear robots with advanced R9 controls (shown at NPE), as well as a new high-speed model.

At least three exhibits will perform in-mold decorating with decorative and/or functional electronic films.

THE 'WOW' FACTOR

As always, the main attraction of K will be live molding demonstrations with an undeniable "Wow" factor that can inspire attendees to challenge the limits of today's technology.

Engel, for example, is pulling out the stops in several exhibits aimed at automotive, electrical and medical markets. For automotive lightweight structural composites, Engel is upping the ante in process complexity and design flexibility. To illustrate current auto-industry R&D into molding parts with targeted load distribution, Engel will operate a cell that preheats, preforms and overmolds three different organosheets in a fully automated process that involves two integrated infrared ovens and three six-axis robots.

The heart of the cell is a duo 800-m.t. two-platen press with a CC300 controller (and C10 handheld tablet pendant) that coordinates all of the cell's components, including collision checking, and stores all their operating programs. That involves 18 robot axes and 20 IR heat zones, and integrated sheet-stacking magazines and conveyors, with just a single Start button and a Stop button that sends all components to their home positions. 3D simulation was used to program this complex cell.

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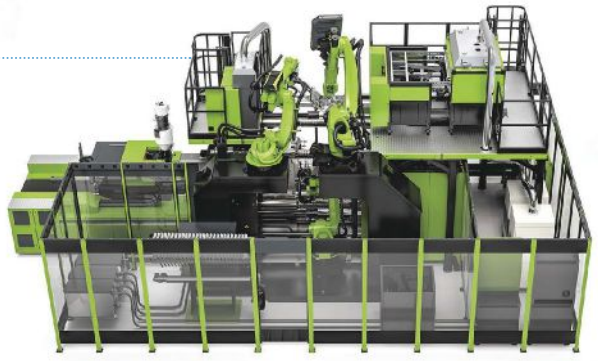
The material for the organosheets is woven continuous glass and PP. Two IR ovens—designed and built by Engel—are mounted atop the machine, one vertically, one horizontally. The vertical oven is positioned directly above the clamp so that the thinnest sheet (0.6 mm) reaches the mold immediately, with little heat loss. A standard horizontal IR oven on a pedestal above the moving platen preheats the two thicker sheets (1 mm and 2.5 mm). This arrangement shortens the distance between oven and mold and saves space, since the oven occupies no floor space.

All organosheets are preheated simultaneously. The sheets are preformed in the mold and overmolded with glass-filled PP in a cycle of about 70 sec. One easix robot handles the thinnest sheet, holding it in front of the oven, and another handles the two thicker sheets. The second robot places the thicker sheets in the horizontal oven and then in the mold (with some overlap). The thickest sheet requires an extra preforming cycle in a separate cavity while the part is being molded. The third robot (floor-mounted, while the others are on top of the machine) moves the thickest sheet from the preforming cavity to the molding cavity and demolds the finished part. Engel notes that this process achieves an "outstanding grained leather look, which was previously considered impossible when it came to organic sheets." This demonstration is said to "lay the foundation for producing large structural thermoplastic door structures using the organomelt process."



Engel's unusually complex cell for lightweight structural automotive composites utilizes three PP/glass organosheets of different thicknesses, which are preheated, preformed and overmolded in a cell integrating two IR ovens and three six-axis robots.

Engel will also demonstrate decorative processes for interior and exterior auto parts. In cooperation with Leonhard Kurz, Engel will operate a roll-to-roll in-mold foil decoration process that vacuum forms, backmolds and diecuts foils in a one-step process. The process is suited to multilayer foils with paint-film surfaces, as well as structured, backlightable and functionalized foils with capacitive electronics. Kurz's new IMD Varioform foils are said to overcome previous limitations on backmolding compex 3D shapes.

At K, Engel will backmold the foil with shredded plant scrap (parts with foil covering) that is foamed with Trexel's MuCell process. Though this application was shown at Fakuma 2018, Engel has further refined the process to trim the product completely in the mold, eliminating a post-mold laser-cutting step.

A second IMD application will use an Engel system at Kurz's booth to overmold thermoplastic front panels with a clear, two-component liquid PUR topcoat for gloss and scratch resistance. The result is said to meet requirements for exterior safety sensors.

Because LED lighting is popular as a styling element in cars, Engel developed a new plasticating process specifically for acrylic (PMMA) to achieve high luminous efficiency and minimize transmission losses. High-quality melt is also needed to fill out fine optical structures around 1 mm wide × 1.2 mm high.

New 'smart' controls, digital services, and networking capabilities will mark the advance of Industry 4.0.

Wittmann Battenfeld will also use Kurz's IMD Varioform foils to mold an auto headliner with a functional surface. It has a partially translucent decorative sheet on the outside and a functional sheet with a printed touch-sensor structure on the inside of the part. A linear robot with a servo C axis has an IR heater on the Y-axis to preheat the continuous sheet. After the functional sheet is inserted in the mold, the decorative sheet is pulled from a roll, heated and vacuum formed. Then both sheets are overmolded.

In a separate demonstration, Wittmann will use its Cellmould microcellular foam process to mold a seat-bench support for a German sports car from a Borealis PP compound containing 25% PCR and 25% talc. The cell will utilize Wittmann's new Sede gas unit, which extracts nitrogen from the air and pressurizes it up to 330 bar (~4800 psi).

For medical and electronics parts, Engel plans two multicomponent molding exhibits. One is the two-machine cell mentioned above that molds an electronic part in amorphous metal and then overmolds it with an LSR seal in the second press. The other demonstration is molding a thick -walled medical housing of clear and colored PP. Using a technique previously applied to thick optical lenses, molding a part 25 mm thick in two layers drastically reduces the cycle time, which would be as long as 20 min if molded in one shot.

The process uses an eight-cavity Vario Spinstack mold from Hack Formenbau in Germany. It is equipped with a vertical indexing shaft with four positions: 1) injecting the clear PP body; 2) cooling; 3) overmolding with colored PP; 4) demolding with a ►

robot. A clear sight glass can be inserted during molding. Stack rotation and operation of eight core pulls are all driven by electric servomotors using new software developed by Engel. Servo control of mold actions is integrated into the press controller.

Among the eight molding exhibits at Arburg's booth will be a functional IMD demonstration of Injection Molded Structured Electronics (IMSE), in which films with integrated electronic functions are overmolded to produce a night light.

Another Arburg exhibit will be LSR micromolding, using an 8-mm screw, eight-cavity mold, and LSR material cartridge to mold microswitches weighing 0.009 g in around 20 sec.

Wittmann Battenfeld will mold LSR medical valves in a 16-cavity mold from Nexus Elastomer Systems of Austria. The system uses the new Nexus Servomix metering system with OPC-UA integration for Industry 4.0 networking. This servo-driven system is said to guarantee elimination of air bubbles, offer easy change of drums, and to leave <0.4% material in empty drums. In addition, Nexus' Timeshot cold-runner system offers independent needle shutoff control of up to 128 cavities and overall control by injection time.

Cosmetic jars and lids based 100% on natural materials will be made by Wittmann Battenfeld in a cell that screws the two parts together after molding.

A Wittmann Battenfeld machine will mold a particularly challenging LSR part at the booth of Sigma Engineering, whose simulation software helped make it possible. A potholder weighing 83 g has a 1-mm wall thickness over 135 mm flow length (see Dec. '18 Starting Up).

Negri Bossi will show a new, patented method for converting a horizontal injection machine into an injection-blow molder for small roll-on deodorant bottles, using a mold from Molmasa of Spain. Another machine at the NB booth will produce a broom brush from foamed WPC (wood-plastic compound) using the company's FMC (Foam Microcellular Molding) process. Available for both thermoplastics and LSR, this technique injects nitrogen gas into a channel in the center of the screw through a port behind the feed section. Gas enters the melt through a series of "needles" in the metering section during plastication.

Wittmann Battenfeld will mold cosmetic jars with lids from a material based 100% on natural ingredients, which reportedly can be recycled without any loss of properties. A two-component press with 4+4-cavity mold will mold the jars with IML using the main injector, and mold the lids with the secondary unit in an "L" configuration. Two linear robots are used—one for label placement and demolding of the jars and one to demold the lids. Both parts are placed in a secondary station to be screwed together.

MORE TECH FOR 'SMART FACTORIES'

Although perhaps not the star of the show this year, the theme of "digitalization" or Industry 4.0 will certainly have a strong presence. Machine suppliers are building out their platforms of "smart machines, smart processes, and smart service":

• Arburg is making its machines smarter with filling simulation integrated into the controls (see above), and a new "Plasticising Assistant" whose functions include predictive maintenance of screw wear. Smarter production takes advantage of the new Arburg Turnkey Control Module (ACTM), a SCADA (supervisory control and data acquisition) system for complex turnkey cells. It visualizes the complete process, captures all relevant data, and transmits job-specific data sets to an evaluation system for archiving or analysis.

In the category of "smart service," the "arburgXworld" customer portal, available in Germany since March, will be available internationally as of K 2019. In addition to free functions such as the main Machine Center, Service Center, Shop and Calendar apps, there will be additional fee-based functions introduced at the fair. These include the "Self Service" dashboard for machine status, the control system simulator, collection of process data, and details of the machine design.

• Boy will produce a hard/soft overmolded drinking cup with individualized production for show visitors. Production data and individual key data for each cup are stored and retrievable from a server.

• Engel is emphasizing two new "smart" control functions. One is iQ melt control, an "intelligent assistant" for optimizing the process. It automatically adjusts plasticating time to minimize screw and barrel wear without extending the cycle, and it suggests optimal settings for barrel-temperature profile and backpressure, based on the material and screw design. The assistant also verifies that the particular screw, barrel and check valve are suitable for the current application.

Another new intelligent assistant is iQ process observer, described as the company's first feature fully embracing artificial intelligence. Whereas previous iQ modules are designed to optimize individual elements of the molding process, such as injection and cooling, this new software provides an overview of the entire process for the whole job. It analyzes several hundred process parameters across all four phases of the process—plasticating, injection, cooling and demolding—to make it easy to spot any changes at an early stage. The software splits the analysis results into the four phases of the process and presents them in an easy-to-understand overview on both the injection machine's CC300 controller and the Engel e-connect customer portal for remote viewing.

Designed for the process engineer, iQ process observer facilitates quicker troubleshooting with early detection of drifts, and suggests ways to optimize the process. Based on Engel's accumulated processing know-how, it's described as "the first proactive process monitor."

Engel promises that there will be more introductions at K, including more condition monitoring features and the commercial launch of an "edge device" that can collect and visualize data from auxiliary equipment and even multiple injection machines. It will enable users to see process settings and operating state of a wide range of equipment and send the data to an MES/MRP computer like Engel's TIG.

• Wittmann Battenfeld will be demonstrating its HiQ intelligent software packages, including the newest, HiQ-Metering, which ensures positive closing of the check valve prior to injection. Another new element of the Wittmann 4.0 program is the electronic mold data sheet, which stores settings for both the injection machine and Wittmann auxiliaries to permit setup of an entire cell with a single keystroke. The company will also show off its condition monitoring system for predictive maintenance, as well as a product of its new stake in Italian MES software supplier Ice-Flex: TEMI+ is described as a simple, entry-level data-collection system that's integrated with the injection machine's Unilog B8 controls.

• News in this area from KraussMaffei includes a new retrofit program to equip all KM machines of any generation with web-enabled networking and data-exchange capabilities for Industry 4.0. This offering comes from KM's new Digital & Service Solutions (DSS) business unit. Among its new offerings will be condition monitoring for predictive maintenance and "data analysis as a service" under the slogan, "We help to unlock the value of your data." The latter will be a function of KM's new Social Production app, which the company says, "uses the advantages of social media for a completely new type of production monitoring." This patent-pending function identifies process disturbances autonomously, based on underlying data, without any user configuration, and provides tips on possible solutions. Like Engel's iQ process observer mentioned above, Social Production reportedly makes it possible to detect and prevent or solve problems at an early stage. What's more, KM says the system is compatible with all brands of injection machines. Its industrial messenger function is intended to replace messaging programs such as WhatsApp or WeChat as a means to simplify and accelerate communication and collaboration in manufacturing. ►

KM will also debut a new enhancement of its DataXplorer software, which provides a detailed view of the process in depth by collecting up to 500 signals from the machine, mold or elsewhere every 5 millisec and graphs the results. New at the show will be a central data-collection point for all elements of a production cell, including auxiliaries and automation. Data can be exported to MES or MRP systems. The system can be implemented in a modular structure.

• Milacron will highlight its M-Powered web portal and suite of data analytics with capabilities such as "MES-like functionality," OEE (overall equipment efficiency) monitoring, intuitive dashboards, and predictive maintenance.

• Negri Bossi will show off a new feature of its Amico 4.0 system for collecting data from a variety of machines with different standards and protocols and sending that data to the customer's ERP system and/or to the cloud. This is accomplished via an interface from Open Plast of Italy, a company dedicated to implementing Industry 4.0 in plastics processing.

Nissei will be one Asian machinery supplier emphasizing Industry 4.0 developments, including complete cell control from the injection press.

• Sumitomo (SHI) Demag will present a connected cell featuring its latest offerings in remote diagnostics, online support, document tracking and spare-parts ordering via its myConnect customer portal.

• While the most active discussion of Industry 4.0 has up to now come from European and American suppliers, Nissei will present its efforts to accelerate development of an Industry 4.0-enabled controller, "Nissei 40." Its new TACT5 controller is equipped with both the OPC UA communication protocol and the Euromap 77 (basic) MES communication protocol. The goal is for the machine controller to be the core of a network of auxiliary cell equipment such as robot, material feeder, etc. with the aid of the still-developing Euromap 82 protocols and EtherCAT. Nissei envisions setting up all the cell auxiliaries from the press controller. Wireless networks will minimize wires and cables and will permit remote maintenance. Nissei is also developing its "N-Constellation" concept for an IoT-based automatic quality-inspection system. PT

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Green's the Theme

in Extrusion and Compounding

Themes of sustainability and the Circular Economy will be visible at the booths of many suppliers of extrusion and compounding equipment—film, in particular.

Many extrusion and compounding machine builders are keeping their K 2019 plans under wraps, perhaps hoping to create a "wow" factor as attendees walk the halls in Düsseldorf next month. What follows is a rundown of new technology news gleaned by *Plastics Technology* though early August.

By Jim Callari
Editorial Director

Kuhne will run a 13-layer Triple Bubble line at an open house during K 2019.

FILM EXTRUSION NEWS

Sustainability and the Circular Economy will be a prevalent theme throughout the show. In blown film, that will be reflected in technology to produce thinner films more consistently, sometimes using biobased materials such as PLA. Reifenhauser says film processors that upgrade lines with its EVO Ultra Flat Plus technology, an inline stretching unit integrated in the haul-off that was introduced at K 2016, can downgauge PLA films by as much as 30%. What's more, because with Ultra Flat Plus the film is stretched while it's still warm, the line can be run at speeds comparable to those of PE film production. This is significant because, according to Reifenhauser, PLA's inherent lack of stiffness generally slows production speeds.

Reifenhauser will also debut a laser measurement system that is said to precisely record the topography of the web so that production parameters can be optimized automatically. "Until now, each film manufacturer had to rely on the experience and precision of its own production technicians," explains Eugen Friedel, sales director at Reifenhauser Blown Film. "By developing the laser measurement system, we can offer our customers more process reliability regardless of the operator. The optimization to preset parameters happens automatically in a closed control loop."

Another trend in blown film that falls within the sustainability theme is polyolefin-dedicated (POD) multi-layer lines to produce film for standup pouches and other products that typically consisted of PE and PET laminations. Reifenhauser reports that its EVO Ultra Stretch, a machine-direction orientation (MDO) device, is being deployed by a processor making breathable backsheet films for a personal-hygiene product. Like the Ultra Flat unit, the MDO is positioned in the haul-off.

Another trend in blown film that falls within the sustainability theme is polyolefin-dedicated (POD) multi-layer lines.

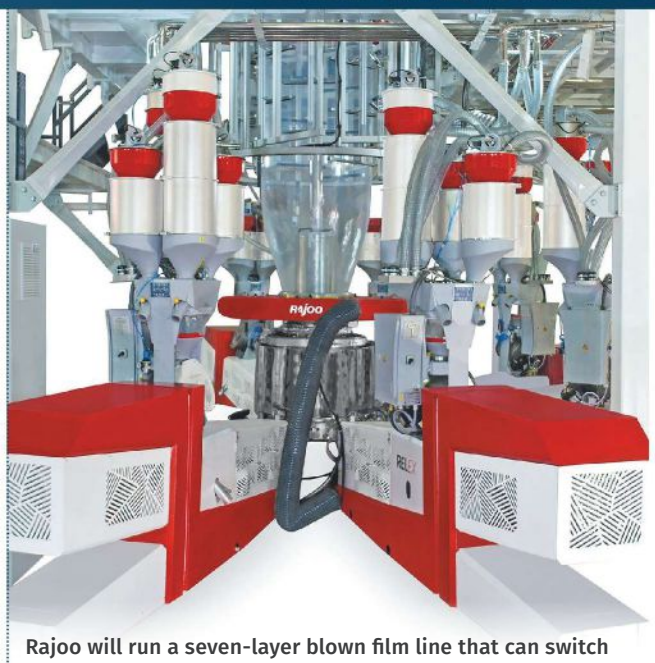
On the matter of POD lines, India's Rajoo will run a seven-layer blown film line called Heptafoil that can switch between barrier-film production and all-polyolefin processing at outputs up to about 1000 lb/hr.

In other blown film news, Davis-Standard (D-S), by virtue of its acquisitions of Gloucester Engineering Corp. (GEC) and Brampton Engineering, will be promoting its Italycs 5 blown-film control system as an upgrade for processors with lines managed by the GEC Extrol control systems. The Vector air ring, introduced by Brampton at K 2016 and displayed at NPE2018, will also be showcased. New air-control technology reportedly can improve the uncorrected film starting gauge by as much as 60-80%. The air ring also is said to provide stable air velocity, resulting in consistent cooling to minimize variations in gauge across the film width.

Also on the matter of air rings, Addex Inc. will launch Phase II of its Intensive Cooling technology at K 2019. "Intensive Cooling" is what Addex calls its novel approach to bubble cooling. Addex's patented design change from the common aerodynamics of present-day blown-film air rings reportedly yields dramatic increases in stability and output. Addex continues to tweak the system for even greater gains when combined with its proprietary auto-profile and IBC systems.

Addex has numerous air rings of this design in blown-film plants for both high- and low-melt-strength processes. The most popular configuration replaces the conventional dual-flow ring's low-velocity, diffused-flow lower lip with a very high-velocity, upwardly directed and focused air stream, which is mounted flat to the die to create an entirely new lock point, about 25 mm above the die lip. The technology is sold as part of Addex's industry-standard Laminar Flow air ring, and also in concert with Addex's auto-profile and IBC systems. Addex guarantees a minimum of 10- 15% average increase in output rate, depending on materials being run; actual outputs have often been much greater. It is not uncommon to see a 30% increase in output, especially for stiffer materials, and in one particular case the output increase was a whopping 80%, Addex reports.

Kuhne Anlagenbau GmbH will showcase a 13-layer Triple Bubble line producing biaxially oriented films for high-barrier food packages such as standup pouches, and high-barrier shrink film for fresh meat or cheese packaging, among other applications. The unique feature of these films is that they will be 100% recyclable. The line will be in operation at Kuhne's plant in Sankt Augustin, Germany.



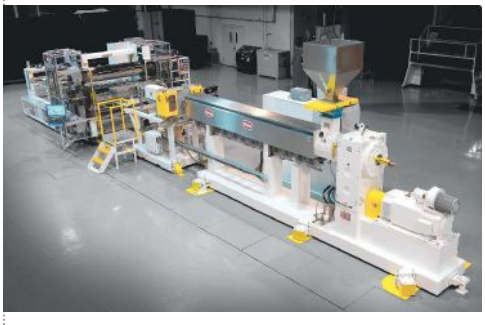
Rajoo will run a seven-layer blown film line that can switch between barrier-film production and all-polyolefin processing.

Amut will be running an ACS 2000 cast line for stretch film. The line on display will feature five extruders in a seven-layer configuration.

In flat film, Bruckner will introduce two completely new line concepts for the production of BOPE films (biaxially oriented polyethylene). Film processors can choose between lines with a working width of 21.6 ft and an output of 6000 lb/hr, or a working width of 28.5 ft and an output of 10,000 lb/hr. The new lines also have the flexibility to produce BOPP films.

Outside the packaging realm, Bruckner will display a new high-temperature concept for BOPP capacitor film; lines for producing "stone paper" based on 60% $CaCO_3$-filled BOPP; systems for making BOPET film for optical applications; and a line for producing biaxially oriented polyimide for flexible optical displays.

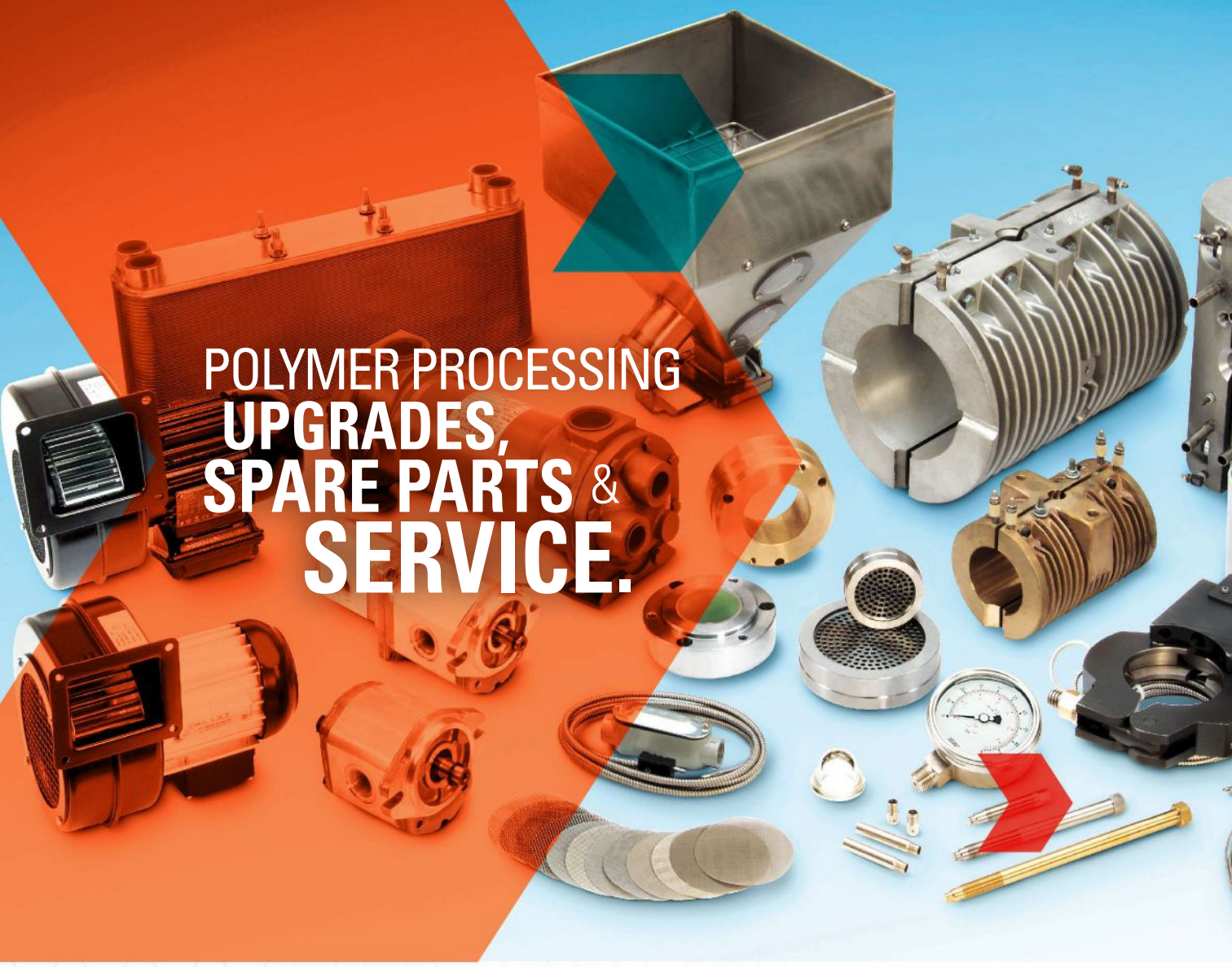
Amut will be running an ACS 2000 cast line for stretch film. It features the Q-Catcher control system, which permits previously saved process parameters to be repeated, allowing for film to be reproduced run-to-run with exactly the same mechanical properties. The line on display will have five extruders in a seven-layer configuration. The line can be run at up to about 2790 ft/min and 2866 lb/hr. Film thickness ranges from 6 to 25 microns. The ACS 2000 will also feature Amut's Essentia T Die.



The Welex Evolution sheet extrusion system on display at K 2019 will be for thin-gauge PP, but can be customized in a range of widths, thicknesses and throughputs.

SHEET NEWS

Graham Engineering will showcase a Welex Evolution sheet extrusion system equipped with XSL Navigator control. While the equipment on display at K 2019 will be for thin-gauge PP, the Evolution system can be customized for widths from 36 to 90 in., gauges from 0.008 to ►



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0.125 in., and throughputs up to 10,000 lb/hr. Monolayer or coextrusion systems are available with up to nine extruders.

In addition to a customized roll stand, the Evolution system can also be equipped with screen changers, melt pumps, mixers, feedblocks and dies. Additional features of the line on display include a proprietary roll-skewing mechanism for thin-gauge applications, maintaining quick-roll change and electric-gap adjustment under full hydraulic load without interrupting production.

Kuhne will be running two Smart Sheet extrusion lines with brand-new features in Sankt Augustin during K 2019. One is for producing PET sheet; the other for thermoformable PP/PS/PE barrier sheet. The PET line will process post-consumer reclaim (PCR) using a Liquid State Polycondensation reactor that is able to accurately control the IV value of the melt—which can be even higher than that of the original material. It will produce FDA- and EFSA (European Food Safety Authority)-compliant sheet for food packaging.

The barrier line will produce seven-layer thermoformable sheet structures for applications requiring long shelf life with what Kuhne says are tight tolerances and excellent layer distribution. The main extruder in the line is a Kuhne High Speed (KHS) model, which is said to reduce energy, floor space, noise, spare-parts and maintenance requirements. This extruder is used for the core layer and will process regrind as well as virgin resin. The line is also furnished with a Kuhne feedblock.

Reifenhauser's REIcofeed-Pro feedblock allows material streams to be adjusted automatically during operation.

Reifenhauser will be showing a feedblock of its own. The REIcofeed-Pro allows material streams to be adjusted automatically during operation.

A high-speed extruder for PET sheet will also be prominent at the Battenfeld-Cincinnati booth. Its STARextruder 120 was developed specifically for processing PET. In the extruder's central planetary-roller section, melted material is "rolled out" into very thin layers, producing an enormous melt surface for degassing and devolatilization. The STARextruder can be used to process both undried new materials and any kind of recycled materials.

PIPE, PROFILE, TUBING NEWS

Graham Engineering will show a variety of American Kuhne extrusion systems for

medical tubing, including Ultra MD systems, compact modular extruders, and other systems such as a tri-layer tubing line. This line consists of three compact modular extruders and the XC300 Navigator control with integrated TwinCAT Scope View high-speed data-acquisition system.

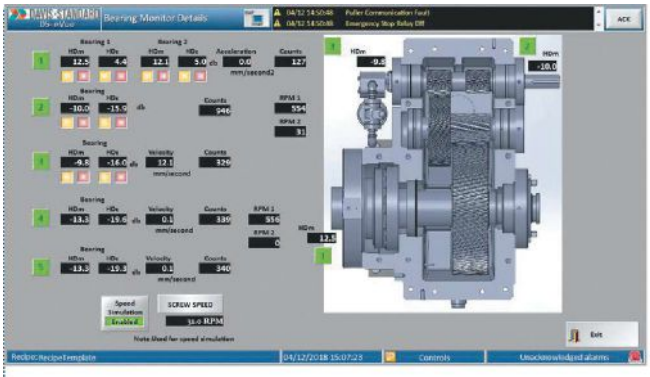
he REIcofeed-PRO allows in which material stsreams to be adjusted automatically during operation.

Davis-Standard will display elastomer extrusion lines for both medical and automotive applications. This includes technology for producing medical-grade silicone tubes, wound drains and catheters, as well as elastomer capabilities for manufacturing hydraulic and automotive hoses and automotive seals. A new crosshead die, The Model 3000A, is said to reduce scrap and speed startup times. The crosshead offers preferred features such as a tapered mandrel and highly engineered flow paths to ensure consistent flow through all speed ranges, as well as a thrust bearing on pin adjustment to adjust wall thickness on the fly.

Also on display at the D-S booth will be extrusion systems for automotive fuel and vapor tubes, micro-drip irrigation laterals, heating and plumbing pipe, blown fiber micro-duct, medical tubes, offshore flexible pipe, custom pipe and tubing, and wire and cable.

On a profile line, Davis-Standard will showcase DS Activ-Check**,** billed as a "smart" technology that enables processors to take advantage of real-time predictive maintenance by providing early notifications of potential machine failures. Machine operators are alerted to issues before they happen, reducing unplanned downtime while also collecting valuable data. Users receive notifications via e-mail or text, and continuous monitoring of machine status is available on smart devices and remote PCs. Key parameters monitored include extruder gear reducer, lubrication system, motor characteristics, drive power unit, and barrel heating and cooling. The benefits of Activ-Check will be demonstrated on a profile line using Microsoft Windows 10 on an EPIC III control system.

For tight-tolerance pipe, Battenfeld-Cincinnati will showcase three products: its fast-dimension-change (FDC) pipe head that enables automatic pipe dimension changes during production, plus

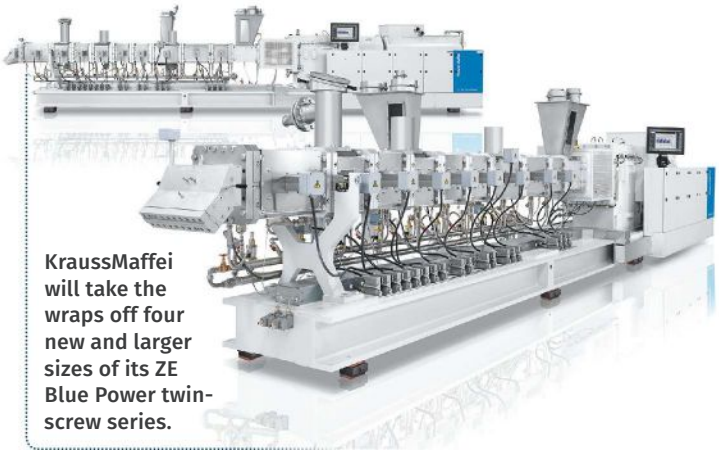


On a profile line, Davis-Standard will showcase DS Activ-Check, billed as a "smart" technology system that enables processors to take advantage of real-time predictive maintenance by providing early notification of potential machine failures.

two new spider NG PVC pipe heads. The first of these tools has already been deployed at customers' sites, and is said to be providing low material consumption and narrow tolerances. In the three-layer head, the middle layer of the pipe is guided by a mandrel-holder geometry, while the geometry of the outer layer has been completely revised. A benefit of the new geometry is its reportedly excellent flushing behavior, said to be a key feature in particular for manufacturing ►

PVC pipes with a foamed middle layer, highly filled compact pipes, or pipes with a regrind middle layer. At the K show, both new spider pipe heads will be teamed with compatible extruders.

The new DTA 160 direct-cutting machine is set to be one of Battenfeld-Cincinnati's biggest downstream innovations for pipe manufacturing. With the new cutting unit, both polyolefin and PVC pipes can reportedly be cut to exact length quickly, precisely and cleanly. A particular highlight of the new chipless unit is that it works entirely without hydraulics. Most importantly, this means that it weighs around 60% less than a conventional system. This enables the cutting unit to move much faster and makes it possible to work with short lengths as a result.



KraussMaffei will take the wraps off four new and larger sizes of its ZE Blue Power twin-screw series.

COMPOUNDING NEWS

In compounding, Coperion will display two significantly redesigned ZSK Mc^{18} extruders with 45- and 70-mm screw diam. and a specific torque of 18 Nm/cm^3. Optimized mechanical and electrical features provide better operating comfort and even greater efficiency. Both twin-screw extruders will be equipped with ZS-B "easy type" side feeders as well as ZS-EG "easy type" side devolatilization. Both the ZS-B and ZS-EG significantly reduce the time needed for maintenance tasks, thanks to the "easy" design that enables quick removal from and re-installation on the process section for cleaning or screw changes. Instead of three-part covers, these extruders are now equipped with single-part heat-insulation covers, which are said to be very easy to handle and can be detached without removing the cartridge heaters.

Coperion will display two significantly redesigned ZSK Mc^{18} extruders with 45-and 70-mm screw diam.

The ZSK 70 Mc^{18} will be on display with a K3-ML-D5-V200 type vibratory feeder and an accompanying ZS-B easy with a K-ML -SFS-BSP-100 Bulk Solids Pump (BSP) feeder. The smaller ZSK 45 Mc^{18} will be equipped with a gravimetric K2-ML-D5-T35 twin-screw feeder and an accompanying ZS-B easy with a K-ML-SFS-KT20 twin-screw feeder for high-accuracy feeding at low feeding rates.

With the dual-bearing SP 240 strand pelletizer, Coperion Pelletizing Technology will exhibit one model from its SP series, which has been completely reworked for greatly simplified handling. Its new cutting-gap adjustment technology makes fine adjustments simpler, faster and more precise; adjustments can be done by hand, with no tools. Furthermore, it markedly reduces maintenance downtime.

KraussMaffei (formerly KraussMaffei Berstorff) will debut four new and larger sizes of its ZE Blue Power Series. From a process-engineering standpoint, the four large extruders (98, 122, 142 and 166 mm) are identical to their smaller sister models. This reportedly ensures consistent scale-up for development and processing of new formulations. The larger extruders also offer the same screw and barrel modularity. A wide range of 4D and 6D barrel sections and various side feeders and degassing units are available.

Exchangeable oval liners provide a cost-effective alternative for extremely wear-intensive processes. KraussMaffei made some minor design modifications to allow for the large size of the new extruders: The housing elements are connected by means of screw unions instead of clamping flanges; cartridge heaters are replaced by ceramic heaters, and their shape was slightly changed.

The combination of large free volume and high specific torque is said to enable "universal application" of the ZE BluePower for engineering plastics and even highly filled formulations. Thanks to the 1.65 OD/ID diameter ratio, the free volume is increased by 27% over KM's previous ZE UT extruder series. In addition, the ZE BluePower features a 36% higher torque density of 16 Nm/cm^3.

Farrel Pomini will feature a Compounding Tower display at its booth, with a live demonstration of its Synergy Control System. The latter features feed-system control from the operator touchscreen; integrated control of upstream and downstream support equipment; automatic startup of downstream processes; automatic shutdown under normal and fault conditions; and remote monitoring and support capability. It's expandable to a supervisory (SCADA) system.

Farrel Pomini's parent company, HF Mixing Group, will show its new Advise 4.0 Mixing Room Automation solution at K 2019. Advise 4.0 is a modular and scalable system that covers every process within a mixing room—from raw-materials storage to manual and fully automated weighing of small components, plus the mixing process, downstream equipment, and storage of mixtures. Separate applications for particular areas and machines can be selected according to requirements and merged together into a single automation system. Standard interfaces reportedlyenable easy connection to ERP systems and laboratory equipment. PT

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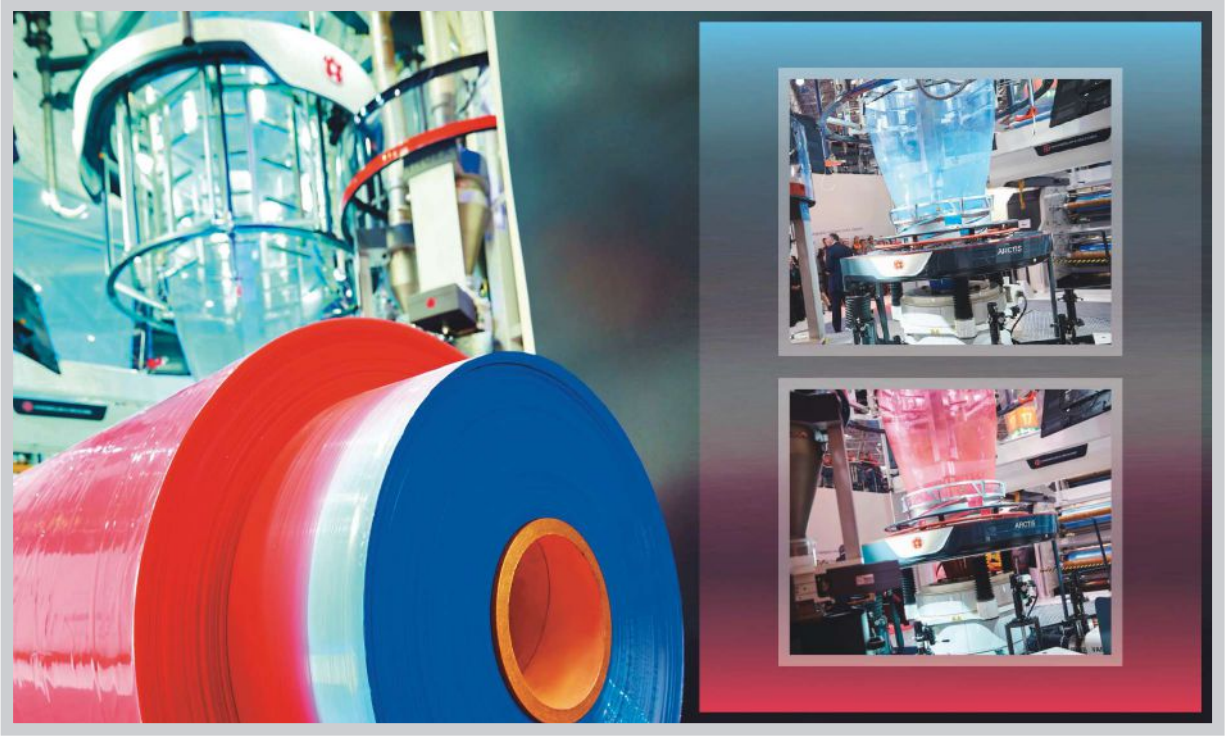

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Blow Molding Exhibits Focus on Recycling & PET

Spotty information from blow molding machinery exhibitors indicates that the "Circular Economy" will be a recurrent theme and that PET processing will predominate.

FlexBlow's new Beauty series two-stage stretch-blow machines offer quick changeovers and "zero-scratch" handling of preforms for cosmetic containers.

With a relatively small number of blow molding machinery exhibitors willing to provide advance information, it's difficult to discern the major trends.

By Matthew Naitove
Executive Editor

However, two themes stand out from data available: First, "Circular Economy" or recycling, the overarching theme of the show, will be featured in blow molding exhibits, too. Second, exhibits of PET blowing systems apparently will far outnumber those for polyolefins, PVC and other thermoplastics.

MACHINES FOR THE 'GREEN' ECONOMY

"Circular Economy" is central to Kautex's exhibit at K. An all-electric KBB60 machine will mold a three-layer bottle from Braskem's "I'm green" HDPE derived from sugarcane. The middle layer will be PCR consisting of *foamed* Braskem

"green" PE. These bottles produced at the show will be reclaimed by Erema at its "Circonomic Centre" in the area outside the exhibit halls.

KHS is being a touch mysterious in saying it will present a "new PET concept" based on a juice bottle as an example. The company revealed few details, saying only that "it combines individual environmentally friendly packaging solutions in one container and thereby supports the theory of circular economy." This new PET bottle, to be presented for the first time at the K show, was designed to have "the smallest possible ecological footprint." At the same time, this "new approach ensures a high level of product protection and a longer shelf life, in particular for sensitive beverages." Further, KHS says it has formed a partnership with an "environmental service provider" to pursue its "strategy of reduction, recycling and reuse."

Agr's new Pilot Vision+ provides enhanced PET-bottle defect detection with up to six cameras—including color sensing—which can be especially helpful in processing high levels of recycled PET.

Agr International is known for its monitoring and control solutions for PET stretch-blow molding. At K, it will show "its latest and most powerful in-the-blowmolder vision system," Pilot Vision+. In keeping with the Circular Economy theme, this system is said to be well suited to quality management of PET bottles with high recycled (rPET) content. It can manage up to six cameras for defect detection inside the stretch-blow machine. Color preform cameras can detect color variations, while the large screen displays defects categorized by mold/spindle and defect type.

Agr also highlights sustainability in showing its latest Process Pilot control system with advanced thinwall capability, introduced earlier this year. It's recommended particularly for ultralight PET bottles, as it measures and adjusts material distribution on every bottle.

'Green' blow molding involves biobased and recycled polymers and lightweighting.

MORE PET MACHINES

Among other exhibits of PET machinery, Nissei ASB will demonstrate its new "Zero Cooling" technology that promises an average of 50% higher productivity as well as higher quality PET bottles. They key is using the second of four stations in its rotary injection stretch-blow machines for *both* cooling and preform conditioning. Thus, cooling of one shot overlaps with injection of the next shot. Ability to use thicker preforms with higher stretch ratios—without sacrificing cycle time—reportedly leads to stronger bottles with fewer cosmetic flaws (*more details in Keeping Up section*).

Meanwhile, FlexBlow (a brand of Terekas in Lithuania) will introduce a special "Beauty" series of its two-stage stretch-blow machines for the cosmetic containers market. These are designed to offer versatility for a variety of container shapes and neck sizes in short-run production. Complete changeover from oval narrow-neck bottles to shallow wide-mouth jars is said to take 30 min. FlexBlow's special pick-and-place system reportedly can feed any wide-mouth preform, even shallow shapes, while minimizing scratches on the preforms.

1Blow of France will be running its most popular compact two-stage machine, the two-cavity 2LO, with three new options. One is a Preferential & Offset Heating Technology Kit, which adds flexibility for producing "extreme oval containers"—even in opaque colors—and offset-neck bottles once thought impossible to make by the reheat stretch-blow process. Second, a tiered-access system limits operator access to particular control functions—as little as on/off and screen-viewing access—while granting technicians full access. Third, in-machine leak testing is now available through cooperation with Delta Engineering. Delta's UDK 45X leak tester uses high voltage to rapidly detect and reject containers with micro-cracks, while saving floor space and capital cost.

Jomar, a leading maker of injection-blow machines, is making an entry into non-stretched PET with its TechnoDrive 65 PET machine at K. Based on the high-speed TechnoDrive 65 unit introduced last year, this 65-ton model is aimed specifically at PET but can easily convert to run polyolefins and other resins with a change of screw and some minor adjustments.

Features tailored for PET include a more robust screw motor, high-pressure valves and built-in nozzle heaters. Some injection-blow machines require a fourth station to process PET. It's used to temperature-condition the core rods. But the new three-station Jomar machine accomplishes this task in the ejection station, reportedly minimizing cycle times. Since injection-blown PET bottles average about 1 mm wall thickness, this machine is said to be suited to jars, vials and bottles ►

for pharmaceuticals or cosmetics, rather than beverage bottles. At the show, it will mold eight 50-ml perfume bottles.

Jomar's new TechnoDrive 65 PET injection-blow machine is its first aimed specifically at non-stretched PET bottles, vials and jars.

OTHER BLOW MOLDING NEWS

For production of unusually shaped technical items, such as automotive ducts and appliance piping, ST Blow-Moulding of Italy will highlight its new ASPI 200 accumulator-head suction blow molder, a smaller version of the ASPI 400 model shown at NPE2018. It's designed to process both polyolefins and engineering resins for either complex 3D shapes or conventional 2D parts. Its hydraulic pumps have energy-saving VFD motors.

For packaging, both Graham Engineering and Wilmington Machinery will display their latest wheel machines—Graham's Revolution MVP and Wilmington's Series III B.

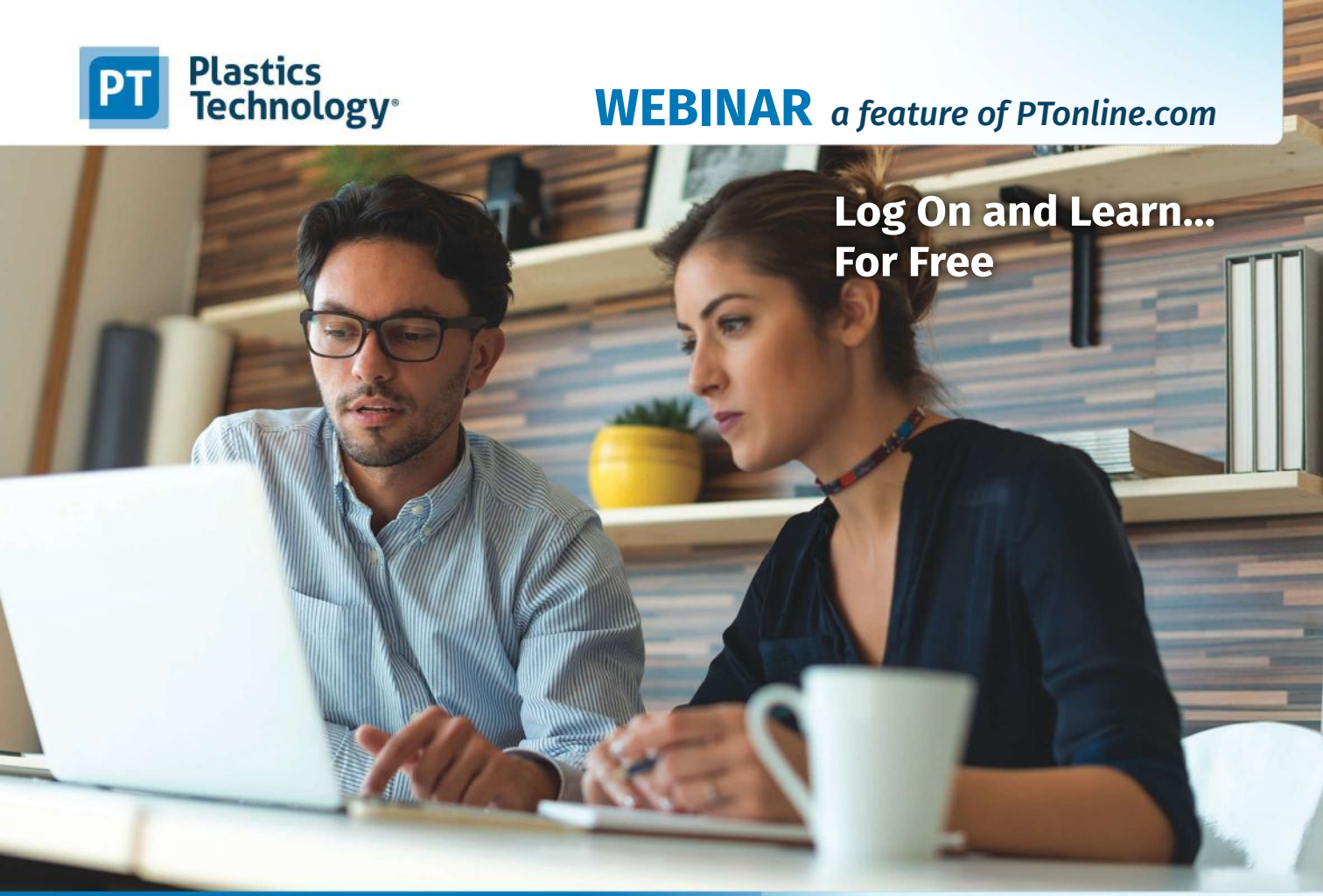
Industry 4.0 will also get its due at K. Kautex will be emphasizing its "new digital solutions in customer service." It previously introduced remote troubleshooting, but is now augmenting it with ability of teams of experts to examine directly a malfunctioning or underperforming machine in a virtual environment. Kautex has also set up a new customer portal for ordering replacement parts. Kautex Spare Parts will allow users to check availability and prices and post orders.

For training purposes, Kautex's virtual-machine control simulators have been enhanced to require operators to react appropriately to process changes. An error-free part is displayed only if the machine settings are correct.

For late-arriving show news from Bekum, see Keeping Up section. PT

Plastics Technology

WEBINAR *a feature of PTonline.com*



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Using Industry 4.0 to Reduce Maintenance Costs and Increase Up Time

Industry 4.0 is still a relatively young topic, but great strides are being made to incorporate new technology into existing and new equipment that allows for eliminating unexpected equipment failures and downtime, as well as increasing productivity. The best systems are making equipment and processes smarter, without adding unnecessary complicated components and software.

PRIMARY TOPICS:

- What is Industry 4.0 and why/where did it start?
- How can I use it starting today?
- What will Industry 4.0 look like in 2 years?

PRESENTER

Alan Landers
Product Manager

CONAIR

Alan Landers has 29 years of machine design experience focused on Industry 4.0, extrusion control, blending, material-conveying and scrap recovery systems for wire and cable, blown and cast film, profile, pipe and carpet fiber manufacturers. His electronic engineering degree and prior experience, provided him with the unique skills required for analyzing difficult process problems, and in-turn, designing unique machine solutions. He is named on three US patents for machine designs for difficult to feed powder and liquid plastics. He joined Conair in 2009.

Auxiliaries Showcase Connectivity & Efficiency

At press time, a handful of auxiliary suppliers shared some of their K 2019 plans, highlighting connectivity and efficiency in their planned displays.

Schwing is displaying a new automatic vacuum pyrolysis system for thermal cleaning of plastics residue from tools and components.

In auxilaries, equipment designed for connectivity and efficiency will be prominent at K 2019, Oct. 16-23 in Dusseldorf.

By Tony Deligio
Senior Editor

HEATING & COOLING

Frigel is promoting what it calls Process-Synchronized Cooling via its new Ecodry System 4.0. Promising full digital connectivity between mold-temperature control and molding machine, Frigel says the system communicates with the molding machine to deliver the proper temperature and flow to the right place, and now, at the right time. In this setup, its range of temperature control units (TCUs)—Microgel, Turbogel and Thermogel—will be paired with its Ecodry adiabatic central water-cooling system for maximum efficiency.

Frigel says this system can achieve cycle-time reductions up to 50%, in addition to savings in energy (up to 30%) and water (up to 95%). Energy savings are derived from the fact that the TCUs will automatically stop operating when production stops, reducing power used in refrigeration and pumping. In addition, chilled water is only used where and when it is needed, and "free cooling" allows the system to use ambient-air cooling instead of refrigeration, whenever air temperatures allow.

Ultra dryers use much less energy when the heated resin is actually dried.

Frigel says Ecodry System 4.0 is digitally synchronized with molding machines and operated automatically by them. Processors can find the best cooling parameters and cycling sequence of heating and/or cooling for each zone of the mold, maximizing processing quality and throughput. These parameters can then be saved and pulled up by the system whenever the molder is running the same job.

Schwing Technologies will showcase a new automatic vacuum pyrolysis system for thermal cleaning of plastics residue from tools and components. The Vacuclean Compact has a maximum load of 50 kg and can be used to clean screw elements, spinnerets, spin packs, pelletizing discs or screen changers, among other components. The system measures 210 × 120 × 100 cm in height/width/depth. The footprint has been shrunk by integrating all key components, including catalytic converter, vacuum pump, control cabinet and fittings. The cleaning chamber measures 50 × 50 × 30 cm. Controls are managed from a 5.7-in. touchscreen. Schwing describes the system as being environmentally friendly due to energy efficiency and low emissions.

Maguire has rebranded its VBD line of vacuum resin dryers with a new name—Ultra.

RESIN DRYING, FEEDING, BLENDING, CONVEYING

Maguire Products is using K 2019 to rebrand its line of vacuum resin dryers with a new name—Ultra. These low-energy dryers are based on technology introduced by Maguire in 2013 under the name VBD. Since that time, Maguire says the actual energy savings achieved with its vacuum technology are greater than originally claimed. Maguire notes that while the energy needed to heat a polymer to its required temperature is roughly the same for both vacuum and desiccant dryers, the Ultra dryers use much less energy in the next stage, when the heated resin is actually dried. As an example, for a process running at 220 lb (100 kg) per hour, for 6000 operating hr/yr, Maguire says the average desiccant dryer might run at 0.06 kWh/lb of material, while the Ultra would run at 0.019 kWh/lb. Both use 0.015 kWh/lb to raise the material to temperature from ambient, but while a desiccant would use an additional 0.045 kWh/lb for drying, the Ultra would only need 0.004 kWh/lb.

Ultra dryers also have load cells on the vacuum and retention hoppers, allowing automatic process control, including startups and stops. The Ultra dryers have a throughput range of 150 to 1000 lb/hr.

Motan-Colortronic will show a new synchronous dosing and mixing unit, which it says can be used with gravimetric and volumetric feeding for starve- and flood-fed applications. The Spectroplus blender has up to eight frame-mounted dosing modules for solids or liquids that can be removed and installed without tools for quick changeovers and easy cleaning. The Spectroplus can be mounted directly on an extruder hopper or on a mezzanine. Compared with previous models, the overall height was greatly reduced, while throughputs remain the same.

Motan-Colortronic's new Spectroplus synchronous dosing and mixing unit features up to eight frame-mounted dosing modules.

The Spectroplus' new load-cell system is a combination of strain-gauge load cells and a digital transducer. Benefits reportedly include ease of assembly and calibration; long life and low-maintenance; and signal transmission with low susceptibility to interference. The Spectroplus also features a completely new control, dubbed Spectronet. This can control both Motan's and third-party dosing units. ►

Coperion K-Tron's SWB-300 weigh-belt gravimetric feeder will be part of an active display at K 2019.

Coperion K-Tron's new V200 vibratory feeder will make its European debut as part of a running system. Coperion will also exhibit its energy-efficient Fluidlift ecoblue pneumatic conveying process at the K. The redesigned K3 vibratory feeder line will be shown in action as part of a recirculating system. Coperion says vibratory feeders are well suited to feeding recycled material or flakes as well as to adding glass fiber in compounding.

Also on display is Coperion K-Tron's SWB-300 weigh-belt gravimetric feeder and the Fluidlift ecoblue pneumatic-conveying system. The company says this technology minimizes material degradation, including development of dust or strands.

Bunting, which has rebranded all its branches under one name as part of its 60th anniversary, will be featuring its Hi-Temp FF Drawer, which can operate at temperatures up to 175 C. Bunting says this special design makes the product well suited to high-temperature injection molding.

Pelletron will feature its Pellbow conveying elbows, including various sizes and types, as well as its XP-15 DeDuster, rated for 1500 kg/hr. In addition, the company will showcase its XP5 Mini DeDuster for up to 500 kg/hr, as well as a rotary-valve display featuring a new compact vent hopper.

Wittmann Battenfeld's auxiliary products will be in action at its booth, serving various injection molding machines, including a central material-handling system; a drying system for PET; mobile Aton dryers; and Gravimax gravimetric blenders. In addition, Feedmax central material loaders and stand-alone material loaders will be in its booth.

Bunting Magnetics' Hi-Temp FF Drawer can operate at temperatures up to 175 C.

The company will also discuss its TEMI+ "entry-level" MES package, which makes it possible to obtain complete, comprehensive data acquisition and analysis of quality parameters from all equipment, including auxiliaries. The production cell linked together via the Wittmann 4.0 router will be able to determine whether the connected auxiliaries are sufficient for the selected product or additional equipment is needed.

A special drying hopper will be part of a medical molding display. A high-speed EcoPower Xpress 160/1100+ will be molding PET blood tubes from a 48-cavity mold. To meet the tough demands for PET plasticating, the press will be equipped with a modified high-performance screw and the aforementioned special drying hopper. Mounted above the injection unit, the hopper will remove moisture from the granulate via a frequency-controlled Drymax 300 dryer. PT

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Molds and More at the Messe

Here's news to look for in molds, mold components, hot runners and controls at the giant K fair in October.

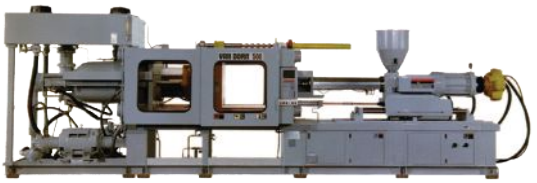
Husky's Ultra Helix valve-gate hot runners promise superior gate quality in hard-to-gate parts.

At press time prior to the big show, several suppliers of tools and hot-runner technologies offered *Plastics Technology* a sneak peek at their plans for the show. Here is what we found:

By Tony Deligio
Senior Editor

Husky Injection Molding Systems will show its new NexPET preform mold, which it describes as a flexible mid-volume tool for shorter production runs and frequent changeovers. In hot runners and controllers, Husky's display will include Ultra Helix 250 T2 valve gates. Husky says these are designed to improve part quality by maintaining superior gate quality for millions of cycles for small parts with difficult-to-access gate locations. On the control side, Husky will display the latest family of its Altanium Mold Controllers. Husky says these provide highly accurate temperature management with integrated servo-motion and valve-gate controls. Husky will also introduce its new online spare-parts ordering portal, which will be available for a demonstration at the booth.

600+



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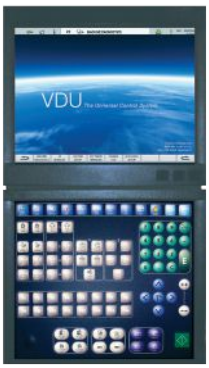

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– Mike McKinley, Pier-Mac Plastics

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– Victor James, Utex Industries, Inc.

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– Brian Vrankar, Endura Plastics

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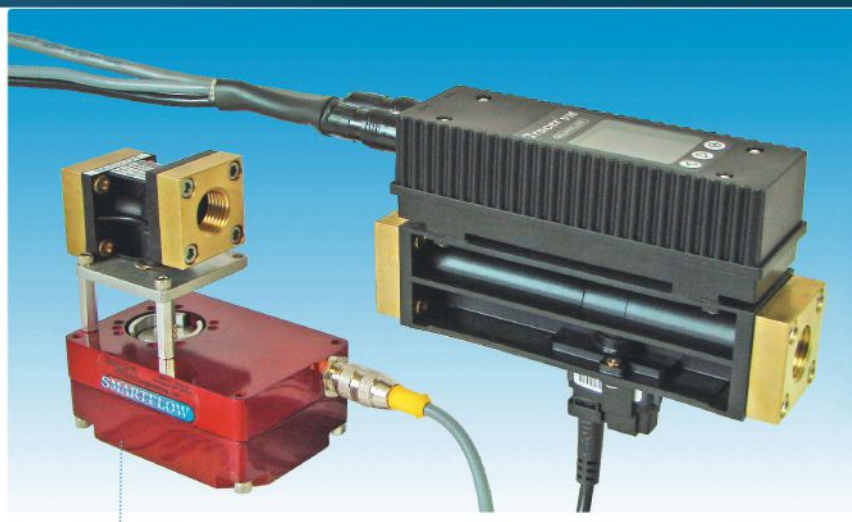


Burger & Brown's TracerVMA with AutoReg can be connected to data acquisition systems or PLCs to give molders real-time statistical process temperature and flow data.

Meusburger will use K to launch its entry into cavity-pressure measurement, adding these sensors to its standardized lines of products for temperature, mold-closing force, and end-position control. Two products—E 6740 and E 6750—are included in the launch, the former for direct measurement and the latter for indirect measurement.

Meusburger notes that these are compatible with all piezoelectric pressure sensors and they are delivered with mounting accessories and connection cables available from stock with CAD data download from Meusburger's online shop. The E 6740 cavity-pressure sensor for direct measurement is inserted directly into the cavity, while the E 6750 cavity-pressure sensor for indirect measurement measures cavity pressure via a force sensor located outside the cavity. Cavity pressure is transmitted to the sensor via an ejector pin.

Cold Jet's patented Particle Control System (PCS) cuts dry ice into diamond-shaped particles in 30 discrete sizes.

Cold Jet will highlight its newest dry-ice blasting machine for cleaning molds and other components. The PCS 60 features Cold Jet's patented Particle Control System (PCS), which cuts dry ice into diamond-shaped particles ranging in size from 3 to 0.3 mm. The size is set by the operator. In addition to cleaning mold and machine components, the PCS 60 can also clean plastic parts before painting.

The PCS 60 has a 7-in. LCD color screen and digital controls, including the ability to program password-protected application recipes. With this feature, users can set and save blasting parameters, such as blast pressure, particle size and feed rate, for a particular job. (For more, see August Keeping Up.)

Hasco's Z960 and Z9610 spiral cores allow cooling along the bore wall.

Hasco is announcing the supply of native data for CimatronE so that customers and designers can retrieve technical data for more than 100,000 products in Hasco's portfolio from the company's website, including the corresponding 3D data records for different CAD programs. Hasco says this updated native data for the CimatronE CAD system allows parametric data to be integrated directly into CAD without the need for an exchange format, which can cause data loss. Hasco's data library has been updated for CimatronE, Version 13.0, including numerous optimizations. Among these is expansion of the ejector range, integration of all Hasco products, and standardization of product names and designations. This new Hasco native database—Cimatron V1 2019/05—will be available for free download at the company's website.

On the component side, the company is introducing new brass spiral cores. The Z960 and Z9610 spiral cores allow cooling along the bore wall for optimum temperature control. The single- and double-threaded versions are made from brass, which provides corrosion resistance and suits the components to use with water, steam, oil and air. The single-threaded model, Z960, can be used in parallel circuits, while the Z9610 double-threaded spiral cores can be run in series. The cores are temperature resistant to 250° C and are compatible with the prior Z96 and Z961 lines.

Burger & Brown Engineering is introducing its Smartflow Tracer$_{VMA}$ electronic flowmeter with automatic flow regulation to the European market. It debuted at NPE2018. The automatic version of the meter modulates the opening of the connected flow regulator according to target flow rate or Reynolds Number input by the user. Automatic flow regulation (AutoReg) is able to compensate for changes in cooling-water line pressure, which occur during normal production due to press startups or shutdowns.

The Tracer$_{VMA}$ with AutoReg can also be connected to data-acquisition systems or PLCs, giving molders real-time statistical process temperature and flow data. Since it monitors cooling-water conditions, it can be used in lights-out molding or sectors like medical, which require process validation.

The SeVG+ system from Mold-Masters includes an SeVG+ controller, featuring a touchscreen display.

English or metric units are available for the system, which can track flow rates from 1 to 15 liters/min through 10 to 200 L/min at operating temperatures up to 120 C. Sizes from ⅜ in. through 1 in. NPT and BSPP are available.

Milacron's Mold-Masters division will show its SeVG+ advanced valve-gate control system, which is now available for all applications. The servo-driven system controls individual valve-pin opening and closing profiles, giving molders the ability to adjust pin position, acceleration, velocity, stroke, timing and sequence. Each SeVG+ system includes an SeVG+ controller, with touchscreen display.

Milacron's DME division is introducing enhancement to its XPress mold base range, adding 25 additional steel grades, all of which are European certified through its "Any Shape, Any Steel" program, according to the company. DME has also expanded the range of its mold components to offer new varieties of standard leader pins, bushings, graphite guiding pins, insulating plates and centering rings. DME says it has also been registered with major designer software programs, including Topsolid, Siemens NX, and DS Catia to facilitate mold design.

New DME system for automatically cleaning mold cooling channels can be especially valuable with conformal cooling.

Finally, DME will also showcase its new automatic device for cleaning, diagnostics and maintenance of mold cooling channels—CoolingCare. The new system automatically cleans mold-cooling lines—including conformal channels—removing rust and calcium, among other deposits, while simultaneously testing for leaks, measuring flow rate and applying rust inhibitor. (For more, see June Close-Up.)

M.R. Mold will feature a two-cavity, three-plate LSR mold for a high-beam automotive lens application. The mold utilizes M.R. Mold's 1-drop cold-runner universal base, feeding two parts. An end-of-arm-tool assists demolding the parts to a robot that will remove it from the tool. Also in LSR tooling, Zahoransky USA Inc. will feature an LSR/thermoplastic overmold tool featuring automation.

M.R. Mold will mold a high-beam automotive lens application from a two-cavity, three-plate LSR mold.

Germany's Heitec Hot Runner Systems, which are marketed in North America via Technoject Machinery, is displaying a variety of hot runners, including its Flex-In and compact cam system. The new Flex-In system allows hot-runner installation in minutes without wire and nozzle assembly; a solid cable channel makes the assembly robust, according to Heitec.

The company says this design eliminates any possibility of incorrect wiring or installation, while also reducing the system's stack height, since a nozzle retainer plate is no longer required.

StackTeck Systems Ltd. will showcase three of its molds in action at K, running in the booths of machinery manufacturers. These molds include low- and high-cavitation tools for round and rectangular containers featuring ultra-lightweight TRIM (Thin Recess Injection Molding) panels, as well as an in-mold labeling technology for a round thinwall lid. Static tool displays in the company's booth will showcase a variety of technologies and applications, including PET preforms, servo-driven technology for different applications, co-injection, multi-material, specialty coating, KoolTrack and closure technologies. PT

Advancing 'Autonomous Molding' with a Uniform-Low-Pressure Process

A new low-pressure injection molding process has aroused interest among molders and machine suppliers. In his second article on iMFLUX, the inventor of the process explains how it is evolving to accelerate the overall industry goal of self-correcting molding processes that can compensate for common causes of variation to maintain consistent part quality.

The iMFLUX low-pressure process "breaks the rules," such as molding thick-to-thin-to-thick in this PP demo part. This application requires automatic control software and sensors that provide absolutely constant filling pressure, with no hesitation, or else the 0.030-in.-diam. x 3-in.-long "filament" portion would freeze off.

Gene Altonen
iMFLUX

The automotive industry has delivered advances enabling cars to assist the operator in braking to avoid collisions, safely maintain a lane on the highway, even automate operations such as parallel parking. Eventually, your car will drive itself. Similar to these automotive innovations, iMFLUX believes the injection molding industry's journey to autonomous molding can be accelerated by leveraging the built-in advantages of what we call the "Green Curve," where controlling the filling process by actual plastic pressure unlocks the ability to deliver many truly autonomous features.

Plastics processors today encounter many barriers to an autonomous injection molding operation. This is because the levers that control the stability of the operation are often varying in ways that are either difficult, or in some cases impossible, for the processor to control. Overcoming these challenges requires: 1) a robust process that can withstand the normal variations in materials, mold, machine, and environment; and 2) a control system that can intelligently adapt to the variations that are outside the normal range of variation.

This is not a wishful fantasy. As discussed below, a process has been developed—and continues to evolve—that can self-correct for variations of up to ±50 MFI units in viscosity, random blocked cavities, leaky check rings, faulty heater bands, and worn screws or barrels—not something a conventional Scientific Molding process can accomplish.

Can your process self-correct for large viscosity swings, blocked cavities, a leaky check ring, faulty heater bands, or worn screw and barrel?

ABOUT iMFLUX

iMFLUX, a wholly owned subsidiary of the Procter & Gamble Co., developed a proprietary control system that enables a new way to injection mold plastic parts. P&G formed iMFLUX in 2013, establishing it in a 200,000 ft² facility in Hamilton, Ohio. After several years of operating quietly within P&G's molding operations and with a select few external partners, iMFLUX recently unveiled the new technology to the world. The company is partnering with molders, machine builders, material suppliers and educators to expand adoption of and innovation with this new processing technology, referred to as the "Green Curve."

For an introduction to the process by this author, see "A New Way to Mold Better Parts Faster and Easier," March 2018.

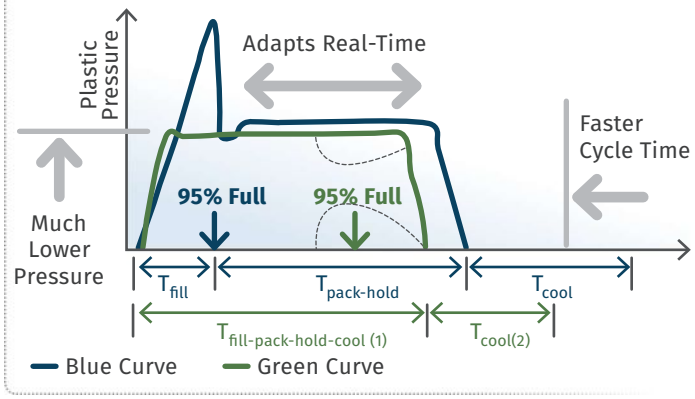
ABOUT THE iMFLUX GREEN CURVE

The Green Curve works by filling and packing the mold using a low and constant plastic pressure. The key to making the process work is a proprietary control system that eliminates flow hesitations, packs the part as it fills, and reduces pressure loss within the mold. This allows plastic to flow much slower than conventional processing techniques, and results in a process with lower pressure, shorter cycle time, and the ability to adapt in real time as molding conditions vary. Advantages include improvements in OEE (overall equipment efficiency), greater material-selection flexibility, improved quality, ability to reduce clamp tonnage, lightweighting part designs, and flexibility in running sustainable materials —especially highly variable recycled materials. Figure 1 shows how the Green Curve compares with a typical decoupled molding process in which control of the filling stage is separated from packing and holding stages.

To repeat the most important point: iMFLUX controls the filling process by maintaining plastic pressure at a lower and more constant pressure. In so doing, the process is inherently less susceptible to variations that shut down a conventional process, referred to here as the "Blue Curve." The reason the process is so robust is that it actively controls plastic pressure during molding, which is the number-one factor impacting the quality and consistency of an injection molded plastic part. This overcomes the inconsistency of conventionally controlled processing where screw velocity is maintained constant, but plastic pressure varies as material and molding conditions change. When it comes to autonomous molding, the Green Curve is steering the process based on what really matters—plastic pressure—a massive advantage.

iMFLUX can adapt the process to handle variations, even variations well outside of the normal range, much easier than can be achieved with a conventional process. This is possible because the Green Curve is a simple process—essentially pressure and time.

FIG 1 Injection on Green vs. Blue Curve



Low, constant pressure in the Green Curve saves time by eliminating pack and hold stages. iMFLUX software adjusts in real time.

On the Blue Curve, adapting to changes requires modifying several variables—injection velocity, transfer position (or cavity pressure), holding pressure, and holding time. What's more, the holding time itself must accommodate variations that have complex interactions.

On the Green Curve, adjustments are limited essentially to plastic pressure (how much pressure is driving the plastic into ►

QUESTIONS ABOUT INJECTION MOLDING?

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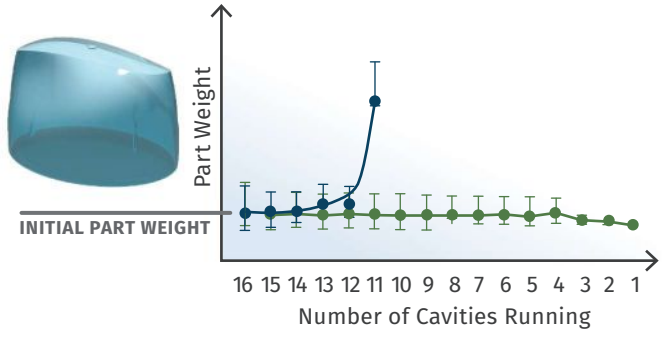
the mold) and time (how long is this pressure applied). The simplicity of the process enables iMFLUX to create highly advanced control algorithms that can handle variations well beyond what is practical on the conventional Blue Curve.

ADJUSTING FOR VISCOSITY SHIFTS

The ability to reliably process variable materials is one of the industry's biggest needs, since processors are being asked to run more and more recycled and lower-cost materials. Often these materials have varying viscosity, making them very difficult to handle. The conventional molding Blue Curve is set up to run parts at a static set of process conditions; and even relatively small material variations require process adjustments to maintain part quality. Recent advances in technology have made it easier to manage material variations on the Blue Curve; yet that process is still inherently unstable due to its sensitivity to transfer position and pressure. The Green Curve is much less susceptible to such changes, since it has no transfer position and adjusts in real time to variations in material rheology.

FIG 2 Progressive Blocked-Cavity Study



In this study, mold cavities were progressively shut off in a 16-cavity deodorant-cap mold. No process adjustments were made. Blue Curve part weights immediately increased, and the mold could not run with fewer than 12 cavities. The Green Curve process ran good parts with any number of cavities.

Blocked Cavities. A traditional molding process is set to inject a certain volume of plastic into a mold, regardless of the ability of the mold to accept this volume. This can create issues if a gate becomes blocked, or if a part is not ejected completely, leaving nowhere for the plastic to go. Depending on the number of mold cavities and cavity volumes, this will result in bad parts and potential damage to the mold.

The Green Curve works differently, since it is continuously controlling the process and monitoring plastic pressure. If a mold cavity becomes blocked, the system immediately recognizes this change and profiles the injection velocity to match what is needed for the current state of the mold. Not only does this prevent tool damage, the process actually makes good-quality parts in the remaining cavities. Similar to automated braking on your car, the system understands when to slow the movement of the screw to optimally fill the cavity. This feature is particularly helpful with multicavity molds where the processor needs to keep a mold running at less than full cavitation. In this case, the mold cavities can simply be turned off *without the need to develop a new modified process*. This is not possible on the conventional Blue Curve.

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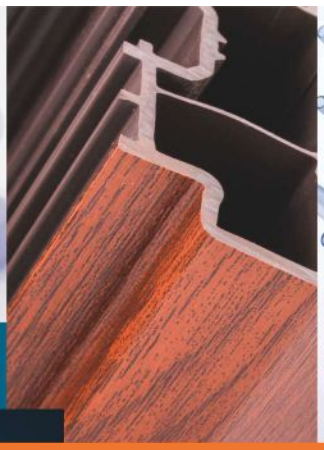
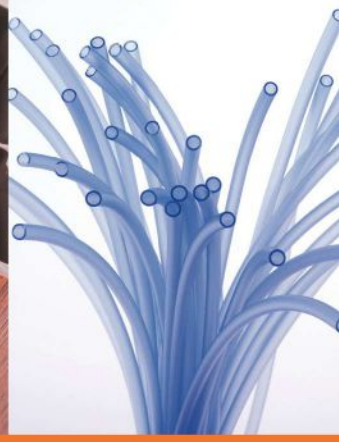

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Achieve Enhanced Cut Quality and Precision with Rotary Knife Cutters

In plastics extrusion, whether it be medical or industrial applications, the cut quality is required to be clean, square, and particulate free. This webinar focuses on the blade and bushing designs to enhance cut quality.

DISCUSSION TOPICS

Blades
- Straight blades
- Blade thickness
- Blade designs for higher line speeds
- Curved blades
- Blade bevels and finish
- Material temperatures for optimized cut quality

Bushings
- Bushing clearance
- Bushing machining
- Bushing materials
- Bolt-together bushings

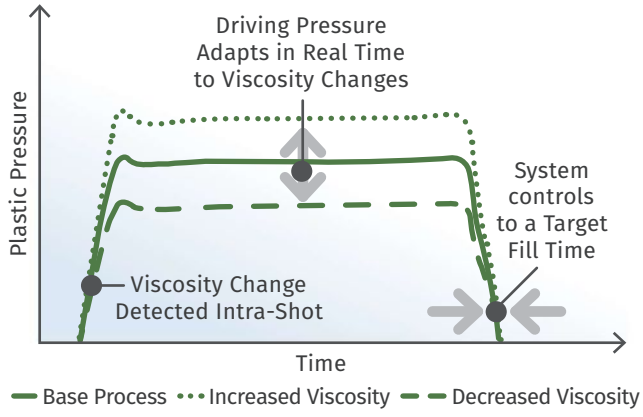
You'll learn:
Attend this webinar to gain a thorough understanding of the extrusion process cutting action and the impact blade and bushing design, as well as the material temperature at the cut site can have on the quality and precision of your cut. Armed with this knowledge, you will have the background necessary to determine the best blade and bushing to be used for your process, as well as the processing parameters to monitor for attaining the optimum cut quality of your extrudate.

Bob Bessemer
Novatec, Vice President of Extrusion Technology

Bob joined Novatec in August of 2018 with a wealth of industry experience, having spent more than 35 years in increasingly more responsible engineering and commercial roles, first at Killion Extruders (now part of Davis Standard), and then 25 years at Conair. Most recently Bob's primary focus was medical extrusion. Bob has been a long-time inventor and patent holder for the plastics extrusion industry.

Figure 2 shows results of a study using a 16-cavity deodorant cap mold, in which cavities were progressively shut off. No process adjustments were made. The conventional Blue Curve part weights immediately began to increase, and the mold could not be run with fewer than 12 cavities. The Green Curve process could run good parts no matter how many cavities were shut off.

FIG 3 **Auto-Viscosity Adjust-Plastic Pressure**



New Auto-Viscosity Adjust software controls plastic pressure to achieve a target fill time.

Leaky Check Rings & Worn Barrels. Consistent check-ring functioning is necessary with traditional velocity-based process control to maintain a consistent polymer volume at transfer. Even small variations can cause big issues with part quality. On the Green Curve, a leaking check ring has virtually no impact on the process, since the process is completely reliant on plastic pressure with real-time feedback. If the check ring leaks, iMFLUX simply accelerates the screw to compensate for the leakage. The Blue Curve relies on static process settings and cannot make dynamic adjustments for inconsistent check-ring performance. On the Green Curve, as long as the press can build plastic pressure, a completely repeatable process can be obtained. This is true whether the repeatability issues are consistent shot-to-shot or sporadic in nature. To achieve truly autonomous molding, the process must be able to adapt to these kinds of common variations, or it cannot be effective in achieving a stable, repeatable process.

LATEST STEPS TOWARD AUTONOMOUS MOLDING

An advanced feature released by iMFLUX earlier this year, called Auto-Viscosity Adjust (AVA), enables the Green Curve to manage even larger variations than the base iMFLUX technology. The new feature can handle viscosity shifts of ±50 MFI or more. AVA works by detecting viscosity changes, then modifying filling pressure to achieve the same filling time shot-to-shot (Fig. 3). Similar to cruise control in your car, the process adjusts in real time without needing operator input. This is true regardless of the source of variation, which can include regrind variation, percentage of regrind, colorant changes, moisture level of the material, or temperature variation. Basically, if the machine can melt it, the Green Curve can process it.

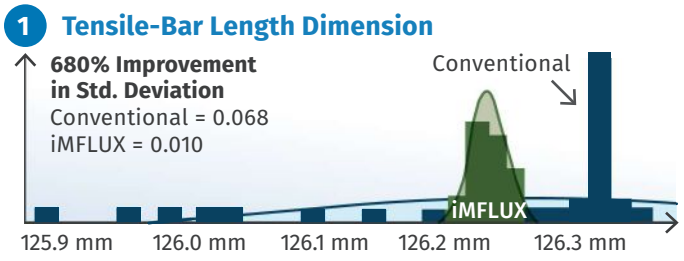
To illustrate the capability of the Auto-Viscosity Adjust feature, iMFLUX performed a running conversion from a virgin ABS to a lower quality reprocessed ABS. No process adjustments were made to the conventional Blue Curve process or to the iMFLUX Green Curve process throughout the run. The AVA feature substantially outperformed the conventional molding process for dimensional consistency, thus demonstrating its ability to dynamically adjust to large material variations. Aesthetic improvements were also observed throughout the run, resulting from continuous optimi-

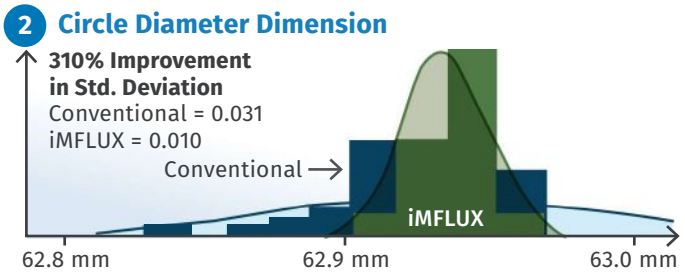
zation of filling pressure provided by the AVA technology. Figure 4 provides an overview of the study.

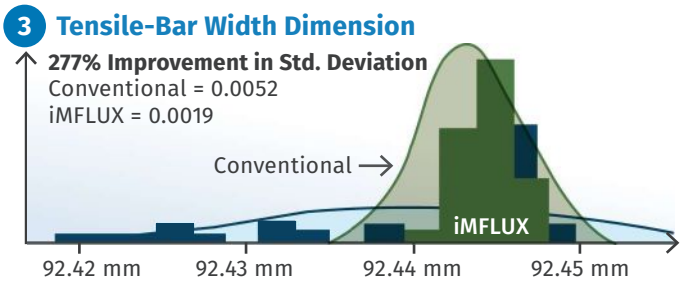
Another feature just released enables the control system to compensate for material density shifts, even shot-to-shot. Called Precision Shot, the technology works by first building shot pressure to a predetermined threshold, followed by metering the shot into the mold (Fig. 5). This feature is only possible when controlling the process using plastic melt pressure, enabling the system to accurately determine that the check ring has seated and that the target compression of the melt has been achieved. ►

FIG 4 **Auto-Viscosity Adjust vs. Conventional Decoupled Process**

In this study, a standard Scientific Molding process and a standard iMFLUX process were established using virgin ABS to mold standard ASTM test samples. While running under stable conditions, a reprocessed ABS was added at the machine hopper. No process adjustments were made.







WHAT'S NEXT?

iMFLUX has a strong innovation pipeline that will enable molding machines to make intelligent decisions on behalf of the operator, ultimately leading to an autonomous molding operation. This vision includes strengthening data-acquisition capabilities, adding learning algorithms to the software, and automating time-consuming and complicated steps such as establishing a process window and intelligently bringing a process up from a cold start or temporary stop.

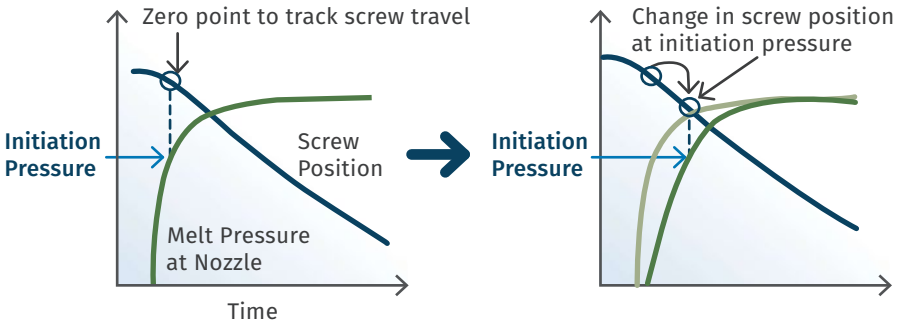
iMFLUX also continues to develop "soft" sensor technology, which derives critical process information without the need for a physical sensor, thus keeping the technology simple and efficient to implement.

WHAT DO MOLDERS & OTHER EXPERTS SAY?

"We truly believe the technology behind iMFLUX will drive a step change in the way injection molding is done. This is why we have been a partner and have systems running on large programs in Europe and North America, as well as development systems in our Innovation Center" –*Kevin Hedspeth, CTO, Technimark, Asheboro, N.C.*

"iMFLUX has proved to be a valuable asset to our injection molding operations. We recently inherited a transfer tool from one of our customers that was under a strict time deadline. Initial sampling with standard decoupled processes were yielding scrap rates of 20-25%. Utilizing IMFLUX's Auto-Viscosity Adjust software, we were not only able to improve cycle time by 15%,

FIG 5 Precision Shot: Establishing Screw Travel Based on Plastic Pressure



With new Precision Shot software, melt pressure is measured in the machine nozzle after the check ring. This enables detecting and automatically compensating for changes in the rise of pressure that may result from wear of the check ring, screw or barrel, or changes in material density.

but also reduce part weight and reduce scrap rate to less than 1%. It was a significant win for both us and our customer." – *Glen Fish, CEO, Revere Plastics Systems LLC, Novi, Mich.*

"The benefits we have seen with iMFLUX have been a reduction in cycle time of existing molds and also the ability with new tools to increase cavitation by up to 50%, which allows us to free up injection molding capacity and production space for other activities." –*Christopher Hay, CEO, Hayco, Hong Kong*

"The Green Curve has proved invaluable in our effort to establish more processes using sustainable resins. Not only have we been able to increase our percent of regrind used, but we are seeing more consistency than ever before." –*Brandon Meadors, engineering manager, Clarios, Milwaukee*

"Over six years ago, our early joint research with iMFLUX identified a number of interesting advantages over conventional molding practices, but also identified a number of challenges. What has been exciting to see is iMFLUX's ability to take these challenges and turn them into strengths. Today iMFLUX has emerged as a method and a highly advanced control system that is providing a much needed alternative to the way the industry currently thinks of injection molding." –*John Beaumont, president, Beaumont Technologies Inc., AIM Institute, Erie, Pa.*

"We are excited to be able to offer iMFLUX integrated solutions, and with Milacron's M-Powered IoT portal we will be able to quickly install iMFLUX technology and offer technology updates as they become available." — *Glenn Anderson, sr. v.p., Commercial-APPT Americas, Milacron, Batavia, Ohio*

"We have customers running iMFLUX in a wide variety of applications, machine sizes, types and resins. Our joint iMFLUX-Milacron customers have seen many benefits, including, cycle savings, energy savings, scrap reduction, reduced tonnage and tighter and more consistent part dimensions. As molders, part designers, and mold builders become more familiar with the constant low-pressure filling, even more significant advantages will be seen as more complex part geometries are developed to take advantage of the iMFLUX process capabilities that are simply too difficult to achieve with the decoupled molding process." — *Andy Stirn, director NPD & product management, Milacron, Batavia, Ohio*

ABOUT THE AUTHOR: Gene Altonen has been the chief technology officer of iMFLUX in Hamilton, Ohio, since 2015. He is the inventor of the iMFLUX core technology, and leads the iMFLUX R&D organization. Gene has spent his entire 29-year Procter & Gamble career developing new packaging solutions, including numerous injection molding technology innovations. Prior to the iMFLUX launch, Gene was a Research Fellow, leading major technology developments in the Injection Molding Capability organization within P&G. He holds more than 50 patents and has at least 50 patent applications pending. For more information about iMFLUX, contact *513-973-2042*; *info@imflux.com*; *imflux.com*.

PT Keeping Up With Technology

PRODUCT FOCUS **Recycling/Scrap Reclaim**

RECYCLING

Next-Generation Shredder Series, New Hot-Wash System

At K 2019 in Düsseldorf in October, German machine builder Lindner will show turnkey shredding and washing systems that it says meet the uptick in demand for higher-quality recyclate for extrusion. Its Micromat shredder series features an overhauled cutter. Also on display with be a new hot-wash system.

Lindner says its display will reflect efforts to find the best combination of shredding, washing, sorting and drying components. The company has implemented NIR (near-infrared) sorting technology as part of its product range.

Lindner and its subsidiary Lindner WashTech, will showcase equipment both on the show floor and outside between halls. Outside, a Lindner system consisting of a shredder and a mechanical dryer will be on display.

RECYCLING

Friction Washer, Bottle-to-Bottle Packaging Application

At K 2019, Amut Group of Italy will showcase a line concept for bottle-to-packaging applications, developed in collaboration with Erema. The extrusion line is designed to process 100% post-consumer PET bottle flakes into single-layer thermoformed sheet certified for food-grade applications. The line has a net width from 1000 to 2000 mm. Though configured with one layer, it can be furnished in three to five layers on request. The line can produce sheet at thickness from 0.15 to 2 mm at outputs to 4409 lb/hr. At the show, the extrusion line will be teamed with Amut's ACF820 thermoformer, equipped with a four-cavity mold producing a dinnerware set.

Amut will also promote its partnership with Ecoplasteam, an Italian company, for POAL (PE and aluminum, commonly called Tetra Pak) waste recovery. POAL, coming from the paper mill after being sorted from cellulose, is washed and pelletized into Ecoallene material. The entire treatment process is completed with Amut equipment. Ecoallene pellets are suitable for extrusion and thermoforming, as well as injection molding.

SCRAP RECLAIM

New Technology for In-house Scrap Reclaim

Erema is featuring new technology focused on in-house scrap recycling at K 2019. New products include the Intarema ZeroWaste Pro system, billed as a compact solution tailored to the requirements of recycling production waste. The optimized design of the machine makes integration into the existing process chain reportedly even easier and enables shorter delivery times for customers. This system is designed for inhouse recycling of flexible packaging scrap composed of multiple materials—such as PE/PET or PE/PP—for up to 1984 lb/hr.

Pure Loop, an Erema Group subsidiary providing shredder/extruder technology, will display the new ISEC evo series, which is a shredder/extruder combination for in-house scrap reclaim, as a supplement to its existing product range. The high-volume model runs at output rates from 3306-3748 lb/hr, while the mid-volume model is rated at 882 lb/hr.

Erema will also introduce BluPort, a newly developed web portal for customers to communicate with Erema. Key features include ordering spare parts online; 40 new maintenance training videos; a dashboard app called My Recycing Plant to monitor machine performance; ROI calculations; and more apps to follow.

RECYCLING

Cloud-Based Data Platform for Sorting Equipment Users

Tomra Sorting Recycling of Norway will highlight its cloud-based data platform, Tomra Insight, at K 2019. Targeting sorting-equipment users, this data turns sorting machines into connected devices that generate process data.

The new platform collects this data in the cloud and turns it into actionable information accessible through a web interface. Secure cloud-based data transmission and storage is provided in partnership with the Microsoft Azure cloud-computing service. Monitoring and reporting functions of this on-demand platform will complement, not replace, existing process-control systems, the company stated.

Tomra Insight provides near-real-time data that is accessed via a secure connection and interface on desktops and mobile devices. This provides machine users the ability to remotely analyze performance metrics and proactively manage machines for performance optimization and preventive maintenance.

By providing digital metrics such as throughput, material and size distribution, acceptance and rejection rates, and more, Tomra Insight is said to give users the operating data necessary to optimize sorting performance. This information can reportedly help reduce machine downtime, optimize machine settings, maximize throughput, sort to target quality, improve the efficiency of machine operators and internal service personnel, and reduce operating costs. Through personal reports and alerts, Insight provides data analytics to help manage proactive and condition-based maintenance, parts ordering and servicing.

RECYCLING/SCRAP RECLAIM

Large Single-Shaft Shredders for Bulky, Tear-Resistant Objects

At K 2019, Weima will present two large single-shaft shredders. Both machines can be used either stand-alone or as part of a production line. Models WKS 1800 and WLK 1500 shred not only bulky objects, but also tear-resistant fibers and film to a homogeneous size.

Instead of a horizontal ram, the WKS Series has a swing-ram system guided on rolls. That makes the shredder very compact and allows a more aggressive material infeed. Due to the low feeding point at a height of about 2.2 m (about 7.1 ft), the WKS can be fed by conveyor belt, forklift truck, or by hand.

All WLK shredders have a Pipespacer hopper that prevents material bridging. These shredders can be fitted with either the universal V-rotor or the F-rotor developed specially for film and fibers. A Vautid wear-protection coating is available as an option for particularly abrasive materials.

The WKS 1800 shredder comes with a rotor diam. of about 500 mm and a sturdy hydraulic drive that allows for stopping, starting and reversing the rotor at any time. The company claims that its simple structure and fast reactions make it resistant to practically any kind of impurity. High torque, even at low power input, reportedly makes this drive energy efficient.

The WLK 1500, with rotor diam. of 370 mm, has new safety features. New at the K 2019 is the modified Weima WAP gearbox. Its safety clutch located in the sensor-monitored belt pulley is said to protect the shredder better than ever from impurities and major damage. Automatic stopping is possible at any time. When shredding thin film, clogging is prevented by the segmented floor guide and the guidance of the ram that presses material against the shredding rotor. The hydraulically lowered swivel screen basket improves accessibility and simplifies maintenance.

RECYCLING

New Regeneration Lines to Recover Highly Contaminated Materials

Gamma Meccanica of Italy will showcase a new series of its Tandem regeneration lines at K 2019. The GM90 Tandem is an intermediate model of the Tandem series developed to recover heavily printed, contaminated and high-humidity plastic materials.

It is composed of the Compac unit equipped with the Ecotronic system that optimizes the speed of the cutter-compactor to maintain the requested temperature without the use of water. Also included is a 90-mm primary extruder; a 105-mm secondary extruder with water-cooled motors; and the TDA 4.0 water-ring pelletizer. The company says its degassing system allows removal of moisture from the melt at performance levels guaranteed to be 10 times greater than other systems. The line can be equipped with different screen changers based on customer needs and the type of material to be recycled.

Production capacity of the Tandem line is between 550 and 1100 lb/hr. After the show, this line will be installed in the new lab center that Gamma is setting up to test materials supplied by customers and to verify the quality of the processes. The new laboratory will have two lines in operation:

the G90 Tandem line for difficult-to-recycle materials; and a GM90 Compac line with a feeding screw for less-contaminated materials coming from industrial waste. For materials that have high fluidity, such as PET or nylon, the tests will be carried out with the firm's new TI 2.3 underwater pelletizer.

RECYCLING/SCRAP RECLAIM

News in Size Reduction & Drying

Herbold Meckesheim is introducing several new machines at K 2019. The company will present its EWS 60/210 shredder, which was developed for dry and wet operations. It boasts a wear-protected rotor that is equipped with bolted armor plating and a special grinding chamber seal, as well as custom knife configurations. The two-sided belt drive is reportedly low-maintenance and has a clutch that prevents damage to the machine when uncrushable feed material is encountered. A new DWS two-shaft shredder will also be showcased. Due to the large surface area of the rotor, the machine is suitable for materials like big bags or large containers that can only be fed in batches on conventional shredders.

Herbold also redesigned its Herbold SB series granulators. Material is not gravity-fed into the grinding chamber from the top as with standard granulators, but by evenly feeding the material horizontally at the height of the rotor using screw conveyors. To accomplish this, the machine housing and feed system were completely redesigned.

Another new machine is a two-stage thermal dryer. Flow through the coils was optimized and the heating temperature was improved to reduce energy consumption. This design is used specifically for recycling thinner films.

HOT RUNNERS

New Multi-Tip Nozzle, Process Monitor & LSR Cold Runner

The HPS III-MV multi-tip nozzle for vertical gating is one of three new entries from Ewikon. Suited to engineering resins with narrow process windows or fiber-reinforced plastics, the HPS III-MV features a coil heater integrated into the pressure tube for stable heating and an even temperature profile.

The nozzles are available in two body diameters that can be paired with several tip insert sizes for simultaneous gating of up to six parts with pitch diameters from 10.5 to 25 mm. A front installation option facilitates easy maintenance. Nozzles can be replaced or tip inserts exchanged once the cavity plate has been removed. An optional hot-sprue version is also available.

A portion of the melt distribution was integrated into the nozzle, keeping the manifold compact and reducing the total flow-path length. This also reduces residence time for temperature-sensitive materials.

Ewikon says its new "smart" control acts as a process monitor for hot-runner systems. Available as an option on new hot halves, it comes wired and mounted. The system monitors, analyzes and logs all relevant process and system parameters over a mold's entire life. Data such as nozzle and manifold temperatures, running times, downtime and shot totals are automatically collected and logged. User-defined critical values can trigger alarms that can be reported by email. All data can be exported via WLAN or Ethernet, and the three digital inputs and two digital outputs can process additional signals. Collected data can be accessed via a browser-based interface accessible from mobile devices or over a company's network. Data can also be transmitted directly to Ewikon for remote diagnosis of system errors.

Finaly, the new CoolShot cold-runner system for LSR features an electrically driven valve gate, which uses stepper motors to position valve pins in increments of 0.01 mm. Valve-pin open positions can be adjusted at any time without cycle interruption. Encoders allow monitoring and automatic adjustment of the valve-pin positions, said to be more convenient than conventional manual mechanical adjustments at the mold. The touchscreen control supports remote access via a tablet PC (iOS, Android, Windows) with VNC viewer.

The water-cooled cold-runner nozzles are available with various tips, depending on the LSR grade being run. These tip options allow the thermal separation to be tailored for faster cycle times.

TOOLING

Insulator Block Protects Cycle Counters, Mold Monitors

Progressive Components says that the maximum operating temperature for its CounterView mold cycle counter is 250 F (120 C) and 190 F (90 C) for a CVe mold monitor. When utilizing an Insulator Block, however, both units can handle mold temperatures up to 360 F (180 C), suitable for running ever more popular high-temperature resins. The block can be installed on either half of the tool.

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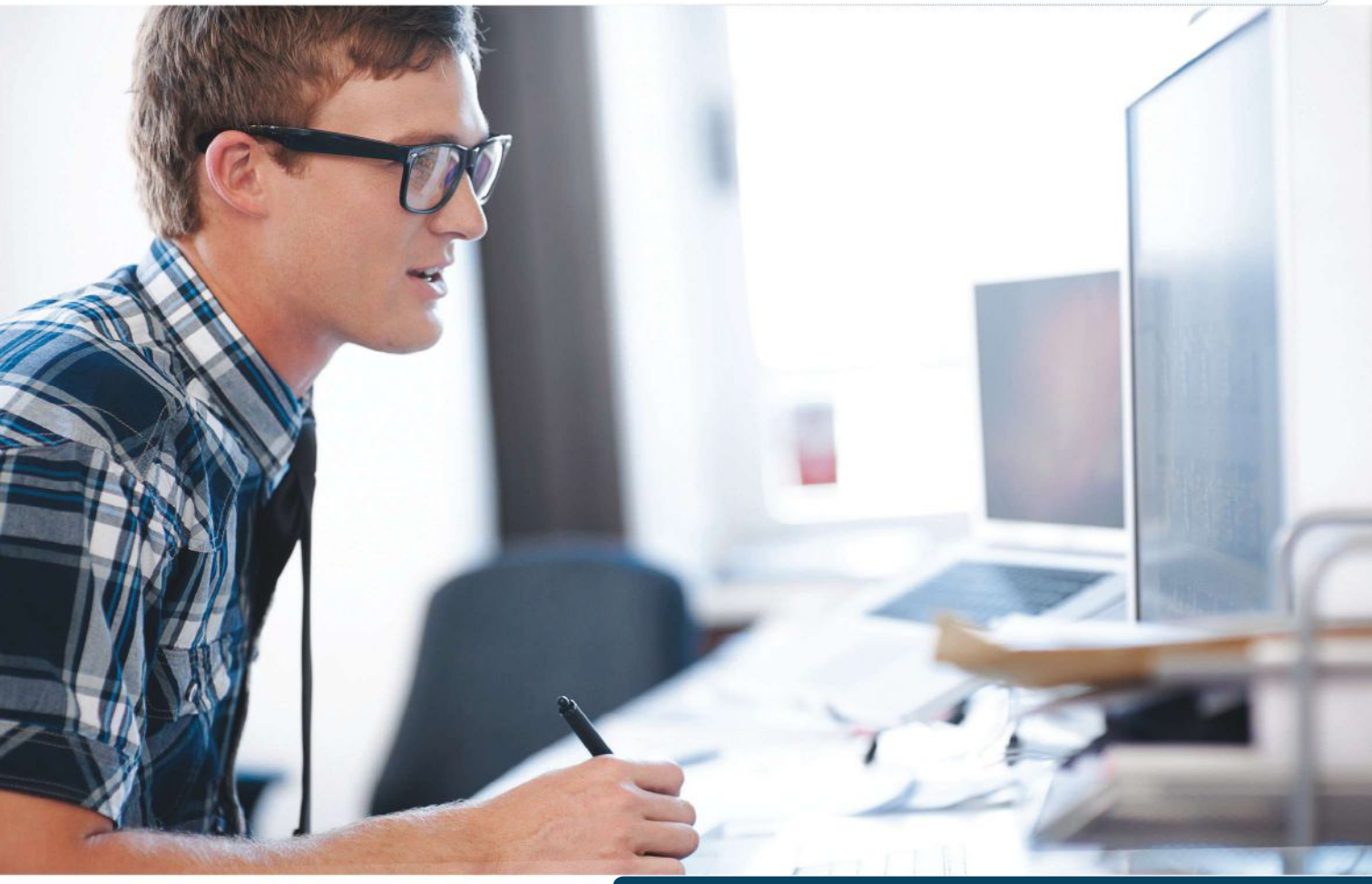

Thursday, September 12th
2:00 PM ET

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Soft Starters: Take It Easy!

Soft starters provide many benefits for control of AC motors in the processing industry. Lower operational costs are achieved by reduced motor inrush current, which contribute to higher electrical bills and possible penalties from electrical utilities. Equipment longevity is improved by reduced mechanical stresses on driven components. Join us as we discuss these and other benefits of soft starters.

PRIMARY TOPICS:

- Available motor control technologies
- Operation cost benefits of soft starts
- Performance benefits of soft starts

PRESENTER

Cory Kersenbrock
Senior Control Engineer

coperion K-TRON

Cory Kersenbrock is Senior Controls Engineer for Coperion K-Tron located in Salina, Kansas, USA. Kersenbrock is responsible for system controls design and implementation. He has nearly thirty years of experience in automation system design including process control, motor control and power distribution as well as construction and installation. Kersenbrock holds a Bachelor of Science degree in Electrical Engineering from Kansas State University.

HOT RUNNERS

System Targets Dust Reduction in PET Preform Molds

Darmstadt University of Applied Sciences in Germany and Mold specialist MHT conducted a publicly funded research project to determine how hot-runner design affects PET preform quality. Researchers examined thermal degradation and decomposition of PET material in the mold, which can lead to dust that impedes valve-needle movement and must be suctioned out. The project's goal was to prevent the dust from developing at all.

The researchers said that part of the issue is that many manufacturers combine an existing hot half, with a mold pitch of 50 × 140 mm, with matching cold sides of different contour. The result is the same hot runner must supply preforms ranging in weight from 6 to 40 g and lengths of 30 to 150 mm.

For the project, MHT built a four-cavity test mold for 12.5 g preforms that simulated the conditions found in a 96-cavity tool by using hot runners connected in series. The mold had pressure and temperature sensors to determine the viscosity of the melt at various points. The mold was run on a KraussMaffei 16-540X injection machine outfitted with an online rheometer nozzle to record viscosity during injection.

The researchers sought hot spots in the test mold and simulations of a 96-cavity tool, and they also looked at straight and curved melt channels of different diameters to see what effect channel geometry had on different polymers. Nine channel models were use with 180°, 90°, and 45° angles and diameters of 4, 6, and 8 mm.

The researchers found that dust formation on the four-cavity experimental mold varied greatly depending on the grade of PET material. They determined that the dust was composed of oligomers that escaped as a gas from the PET and then condensed on the mold surface.

Ultimately, the researchers developed an equation that could calculate whether a disruptive amount of dust would be produced during molding, based on the PET resin grade, preform weight, maximum residence time, and hot-runner volume .

Using this, the team designed a new hot runner that aims to transport PET melt rapidly and gently. This was installed in a 96-cavity prototype mold with a 50 × 140 mm pitch that was tested at an MHT customer for one year. The test reportedly showed greatly reduced dust formation even though the preforms were made from a material mix featuring 70% recycled resin.

The new two-plate hot runner is undergoing further development and is scheduled to launch at K 2019. It features several standardized elements that are inserted in the manifold block. Melt is fed centrally and the hot runners are naturally balanced, according to MHT. To preload the system, springs are installed at the point where the melt is transferred between the cross manifold and two sprue bushings of the manifold. This results in a fully sealed and leak-free system, hot or cold.

EXTRUSION

Gauge Measures Haze of Narrow or Wide Webs

NDC Technologies is debuting a new gauge at the upcoming K 2019 show that enables processors to accurately and reliably measure the haze of film and sheet online and generate real-time reports.

Film or sheet with a poor appearance can be problematic for processors trying to maintain a specific quality standard. NDC's new HazePro gauge reportedly solves this problem by measuring the haze of both narrow and wide films online with the highest accuracy and reliability. With HazePro, manufacturers can precisely adjust the film and sheet extrusion process to tightly maintain haze quality. Process adjustments can be automated for real-time control of haze. Applications include optical, packaging, agricultural and solar-panel films and other uses.

NDC's haze measurement complies with ASTM standard D1003 for transparent materials.

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INJECTION MOLDING

New Automation Approach for Medical Pipette Tips

The newest generation of its automated system for demolding and packing medical pipette tips will be demonstrated at the K 2019 show by Hekuma GmbH. The new Heku*tip* system is said to far outperform earlier versions. One new feature is the gripper system for the linear robot (photo), which reportedly enables takeout times of less than 0.6 sec for 16 to 128 cavities. Overall cycle times of 4 to 4.5 sec are said to be achievable.

Additional time savings result from parallel movements of the servo-driven handling axes, which also offer extremely high and repeatable positioning accuracy. Simple setting options enable fast format changes from the operator terminal. "On-the-fly" camera inspection can provide 100% quality-assurance checks for presence, I.D./O.D., horizontal and vertical burrs, spray skin, edge ejection, etc. Only 1.25 sec are required to fully inspect 24 tips. Reject parts are automatically removed and replaced with known good parts. A reject rate of up to 8% can be accommodated without effect on system cycle time, Hekuma claims.

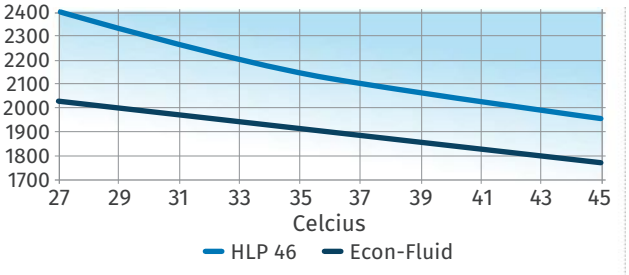
Filled racks are also inspected for completeness and presence. Users have the option of filling racks with mixed or cavity-separated product for maximum traceability. Modular design of the system allows flexibility for different cavitation, choice of 100% camera inspection or random control, optional labeling or marking of product racks, and further packaging options for the racks, such as stacking, lidding, banding and shrink wrapping. Systems can also be configured to include filter separation, feeding, filter assembly and batch tracking.

A 64-cavity Heku*tip* system will be demonstrated at Sumitomo (SHI) Demag's booth.

INJECTION MOLDING

Optimized Hydraulic Oil Promises Energy Savings

Boy Machines is now optionally equipping its servohydraulic injection machines with an "optimized high-performance hydraulic oil" that is said to offer potential for considerable energy savings due to its viscosity profile. As shown in the accompanying graph, the pump motor consumes fewer kW with this oil, dubbed EconFluid, over a range of operating temperatures.



BOY Econfluid shows a significantly lower power consumption that the standard oil HLP 46.

Says Martin Kaiser, Boy's head of mechanical design in Germany, "Extensive tests with EconFluid showed a significantly lower power consumption of the injection molding machines in comparison with the commonly used hydraulic oils." For example, power consumption dropped from 1950 W to just 1765 W during a sample cycle. The Boy 35 E reportedly consumes up to 10% less electrical energy with this new oil. Other benefits are said to include consistently lower oil temperature, which saves energy for oil cooling, and longer oil-replacement intervals. With appropriate care, Boy says, EconFluid can be used for up to five years.

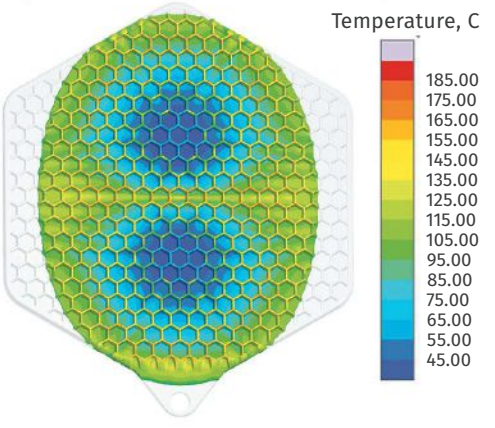
For other articles on energy-saving hydraulic oils, see Feb. '17 Starting Up and Jan. '18 Close-Up.

INJECTION MOLDING

New Software Shares Simulation Results Among Development Partners

At the K 2019 show in Düsseldorf next month, molding simulation software provider Sigma Engineering will present its new SigmaInteract. It allows different departments within a company, as well as different companies—project partners and customers—to share interactively the results of "virtual DOE" performed by Sigma's Autonomous Optimization software (see Feb. '18 Keeping Up and May '18 online feature).

The possibilities for "interdisciplinary exchange" will be demonstrated at K through a live demonstration of molding a particularly challenging LSR application—a pot holder with complex geometry, thin walls and long flow lengths (see this issue's injection molding K preview feature). For this project, part design and tool construction were conducted in parallel, so it was essential for all partners—LSR material supplier Momentive Performance Materials, toolmaker Emde MouldTec, and machine suppliers Wittmann Battenfeld and Nexus Elastomer Systems—to work closely together. Virtual DOEs by Sigma determined the optimum gating and heating arrangements and the need for venting, and helped in selecting the LSR material and redesigning part of the pot holder for faster cycling. Simulation also helped determine the minimum injection and clamp pressures needed, so that the smallest possible injection machine could be chosen for the project.



At the show, visitors to Sigma's booth can see the pot holder being molded, both virtual and live, at the Wittmann Battenfeld booth. Results of both live molding and interactive 3D simulation results will be presented on the Wittmann Battenfeld machine controller via SigmaInteract—demonstrating how simulation and production can be linked together.

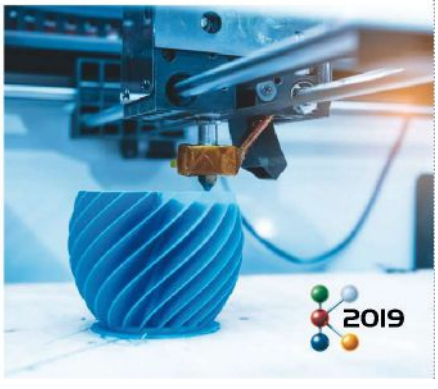
ADDITIVE MANUFACTURING

New Urethanes Product Platform

During K 2019 in Düsseldorf, Huntsman will launch its Iroprint additive-manufacturing platform, which contains three different kinds of urethane-based materials (resins, powders and filaments) that can be printed using a variety of methods, including stereolithography (SLA), high-speed sintering (HSS) and fused-filament fabrication (FFF).

Initially, Huntsman is launching its Iroprint materials for the global footwear and sports industry. They include:

- Iroprint R resins are a range of soft, durable, one-component liquid resin systems that can be 3D printed using SLA, digital light processing (DLP) and other radiation-curing methods.
- Iroprint P powders are a line of TPUs for HSS forms of printing.
- Iroprint F filaments are a collection of TPU materials that have a consistent diameter and are designed for use with fused filament fabrication (FFF) and other extrusion-based printing techniques.



EXTRUSION

'Unique' Digital Services for Film Processors

Brückner Servtec will be introducing "Brückner One" digital solutions for film production. This is billed as unique in the biax film industry: It is a one-stop solution providing a digital platform supporting all aspects of the line and its operation. It brings field-proven service products to a new digital level, and enhances them with additional features. Brückner calls this the base for transparent, faster and more efficient service. It helps to maximize the availability of film-stretching lines and to minimize maintenance and downtime costs.

At K 2019, Brückner Servtec will present enhanced digital service solutions with separate modules for service requests, spare-parts inquiries, communication, and line documentation:

- For quick and flexible troubleshooting, the Brückner One Support module offers an advanced system for technical-service requests regarding electrical, mechanical and process support. It is also available as an app for mobile devices. The customer submits a service request and tracks its status online.
- The Brückner One Parts module allows rapid and simple identification of film-stretching line spare parts in an online catalogue with drawings, descriptions or part numbers, which can be forwarded to Brückner.
- Brückner One Com allows flexible interaction between the Brückner service team and the customer. It is a module for quick and easy communication using chat, video and whiteboarding. The customer can also use the app version of the module for mobile devices.
- Brückner One Docu provides paperless and simple-to-use online technical documentation. Thus, the customer has all relevant information when performing service on the production line. Furthermore, Brückner One Docu allows addition of short video sequences to demonstrate service procedures right where they are needed.

Plastics Technology

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Wednesday, September 18th
2:00 PM ET

Register for this webinar at:
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Molds In Motion

ALBA Enterprises offers a variety of unique solutions for movement in plastic injection molds and die-cast dies. VEGA Hydraulic cylinders, ALBA couplers and ALBA Latch Lock's are the three products to be discussed. Please join us and bring your questions!

PRIMARY TOPICS:

- **Discover VEGA hydraulic cylinder solutions engineered specifically for the plastic and die cast industries and the unique features offered.**
- **Discover key features of the ALBA mechanical coupler and plate actuation systems.**

PRESENTER

Richard Oles
President/CEO

ALBA ENTERPRISES

On November 1st, 2018, Oles merged his consulting company (ROI Rich Oles Industries) with the distributor ALBA Enterprises and joined as the company President/CEO and 50% owner at ALBA Enterprises, LCC.

At NPE2015, Oles launched his Michigan-based consultancy ROI Rich Oles Industries, LLC and, simultaneously, became the Midwest distributor for heating element, thermal sensor and control technology firm Hotset GmbH of Lüdenscheid, Germany, through its Hotset America Corp.

EXTRUSION

‘Hybrid’ Tool for Pipe, Tubing

Guill Tool & Engineering has introduced a new Hybrid version of its 800 series multi-layer dies. It was created for extrusion applications using crossheads and inlines, where layers of the same material are applied multiple times using a single die. This method is used to reduce errors caused by gels breaking through a thin wall, as well as weld lines, inconsistent wall thickness, and material and process variations. Additional challenges include difficult-to-process materials and demanding applications with zero fault tolerance.

To overcome these challenges, the 800 Series Hybrid incorporates the benefits of layer overlapping while reducing unnecessary complexity and making the technology more affordable for customers. This was achieved by overlapping layers in each semi-deflector, using a single cone. The highly efficient design of the 800 Series Hybrid reduces cost and size, as opposed to other methods of overlapping layers. The 800 Series Hybrid retains the inherent benefits of the 800 Series, including compact design, low residence time and a common deflector bore that eliminates tolerance stack-up.

Benefits of the 800 Series Hybrid are said to include eliminating weld lines through patented overlapping technology, reduced sensitivity to changes in viscosity and line speed; low residence time; compact design; and low tolerance stack-up errors—all resulting in improved concentricity. It reportedly works in all tubing and jacketing applications with a wide range of materials.

The 800 Series Hybrid extrusion tool greatly reduces stagnation, because overlapping layers are more inherently balanced than single layers, and also because each semi-deflector is “tuned to flush.” Conventional deflectors must simultaneously achieve a balance between flushing, balancing and eliminating the weld line. But with the 800 Series Hybrid, there is less difference between the slowest-moving and fastest-moving material in the deflector channels, thus making the viscosity more consistent in the deflector.

BLOW MOLDING

“Zero Cooling” Boosts Productivity of One-Step PET Stretch-Blow Machines

As noted in the K 2019 preview feature on blow molding in this issue, Nissei ASB will showcase its new “Zero Cooling” technology that boosts productivity of one-step stretch-blow machines by two or three times, as well as allowing for improved PET container strength and visual appearance. The key is moving the cooling stage to the preform-conditioning station of four-station rotary machines. That frees up the injection station for the next cycle before the previous shot has cooled.

Nissei ASB will operate five PET machines with Zero Cooling. Two of them will mold 100% recycled PET (rPET) to confirm the versatility of Zero Cooling. Two of these machines were also exhibited at NPE2018 in Orlando: ASB70DPH v4, a mid-range model that can mold a single 10L jar or up to 12 sub-100-ml bottles; and ASB-12M v2, a small model shown at K with an optional IU-10L long-stroke injection unit that provides a 50% increase in shot capacity for large containers or heavyweight cosmetic bottles—or materials such as PP with lower density. As at NPE, it will mold a premium glass-like cosmetic container using standard PET rather than the high-priced, slow-crystallizing specialty grades usually required for such a thick container.

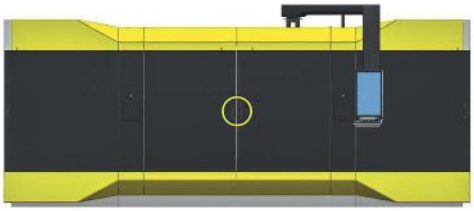
Also on display will be a fully re-engineered ASB-70DPH Advanced Version, that has 40% faster indexing while molding small containers. A double-row ASB-70DPW v4 for small bottles up to 1L in eight to 24 cavities will also be shown, molding an oval shampoo container. The largest model on display will be an ASB-150DPW double-row machine for high outputs of small to medium-sized jars and bottles. Its output is typically around 2.5 times that of the smaller ASB-70DPW.

BLOW MOLDING

New Packaging Machine Concept Previewed at K 2019

While many exhibitors at the K 2019 show next month in Düsseldorf will show off their latest current products, Bekum will offer a peek at what lies ahead. Its “Concept 808 future packaging machine” offers sleek lines and large safety gates, as well as variable-color LED lights that indicate operating status. It also has a new generation of high-output extruders that boast high energy efficiency.

The brand-new Bekum Control 8.0 for these shuttle machines offers a 24-in. touchscreen with multi-touch capability and displays of throughput and consumption of power, water and air.



Also featured is optional magnetic clamping for quick change of molds and blow pins. Mold change reportedly takes 15 min without tools or a special mold cart.

Plastics Technology®

WEBINAR *a feature of PTonline.com*

Thursday, October 10th
2:00 PM ET

REGISTER FOR THIS WEBINAR AT:
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How to Implement a Purge Program & Stop Wasting Money

Many processors know that they should implement a purge program but just don't know how to get started. This presentation will discuss what data to collect, how to collect it, and how to measure performance when you introduce purging to your process. Our purging expert will explain different tangible ways purging compounds can improve efficiency and will discuss several customer examples of how purge programs helped them reduce costs.

PRIMARY TOPICS:

- Understand your processing data
- Choose a Purging Compound that fits your needs
- Address existing processing pain points
- Introduce a plan to improve efficiency moving forward

PRESENTER

Jarred Packard
Project Engineer

ASACLEAN
Purging Compound

Jarred Packard is the Project Engineer for Sun Plastech, Inc. — the manufacturer and distributor of Asaclean Purging Compounds. He is a purging compound expert specializing in new product development for Asaclean. Packard joined Sun Plastech, Inc. in 2017 after working in the packaging industry. Contact: (973) 257-1999 x248; email: jpackard@asaclean.com.

THERMOFORMING

Steel-Rule Former is Fast, Easy to Operate

Kiefel will be running its next-generation steel-rule thermoformer at K 2019. The Speedformer KMD 78.2 Speed is said to offer higher productivity, process control and availability, as well as trend-setting intuitive user guidance in operation and maintenance. The heating system is ready for use in a very short time and offers 20% higher heating capacity—despite reduced energy consumption. In combination with the servo drives' energy-recovery system, this reportedly leads to considerable energy savings.

A newly developed film-feed table gently guides the film to the film-transport system. Further optimized forming-air/vacuum system reportedly improves quality of formed parts. Ergonomic tool-change systems can significantly shorten setup times. The many improvements and details add up to significantly increased uptime for the KMD 78.2 Speed.

On-screen pictograms and graphics, some animated, aid adjustment of machine parameters—and fault diagnosis and correction as well. The new KMD controls need operator input of only a few parameters; the rest are determined automatically. The display shows the entire forming process and other important processes at a glance.

COMPOUNDING

Multi-Shaft Mixer for Hot Melts, Viscous Dispersions

A special Triple-Shaft design specifically suited for hot melts and viscous dispersions, the Ross Model CDA-800 has a mixing capacity of 500–800 gal and is designed for full vacuum operation (29.5 in. Hg). The mixer is suitable for high-heat operation up to 600 F and includes an insulated, 50-psig, stainless-steel, dimpled jacket covering the side and bottom of the mixing can.

In addition to the standard three-wing anchor for bulk flow and heat transfer, the unit has two reversible high-speed disperser shafts, each featuring two 16-in., height-adjustable blades of the classic disperser design. The removable mix vessel sits 24-in. above the floor for convenient discharge. Speed, time, temperature and vacuum level are displayed on a 10-in. touchscreen and controlled via PLC.

DRYING

Compressed-Air Dryers Reuse Process Air

FarragTech of Austria (U.S. office in Glendale Heights, Ill.) will feature its CARD (compressed air resin dryer) technology at K 2019, as well as internal blow molding cooling units. The CARD E/S, CARD M and CARD L/XL dryers and Blow Molding Booster and Blow Air Chiller internal cooling units will be presented during the show.

The company notes that in extrusion blow molding, it was standard to vent the dry blowing air at the end of each cycle. Seeing this as wasteful, company founder Rainer Farrag developed CARD technology in 1991 to reuse the blowing air for resin drying. Since that time, FarragTech says it has made improvements, including better process integration and new controls, including a sleep mode. With sleep mode, the amount of air is reduced after reaching a set temperature in the upper range of the drying hopper. Heat recovery from the air compressor has further boosted efficiency.

FarragTech notes it has combined the dehumidification of the resin with the internal cooling of the blow molded product, avoiding material stress due to the additional condensation water of the supplied exhaust air. As a result, production reportedly can be increased by 35% with greater quality and lower costs.

COMPOUNDING

Strand Pelletizers Improve Quality, Ease Handling

At the upcoming K 2019 show, Coperion will be introducing improved dual-bearing strand pelletizers. The SP140, SP240 and SP340 models have enhanced features for easy, rapid handling and optimized pellet quality. The heart of these new units is a new, proprietary technology for the cutting-gap adjustment that reportedly offers increased comfort and speed compared with standard systems. Coperion says conventional solutions like eccentric screws or compression-tensioning screws present disadvantages such as non-linear movements, potential dirt pockets on the product, several setting steps, or subsequent shifting from additional locking mechanisms. Coperion's new solution reportedly offers faster and more comfortable adjustment. Fine adjustment is also simpler and more precise, as it can be done by hand without tools. Likewise, the integrated spring pre-tensioning eliminates the screws' free clearance, markedly reducing machine setup times.

Along with a more compact design and integration of the operator panel into the machine, reworking of the interior space positions cutting tools closer, enabling a shorter, unguided strand length in the pelletizer and better cutting results, especially with soft materials. This new construction results in less dead space in the interior, which, together with optimized edges and fewer free surfaces, provides improved cleanability. The complete cutting area is accessible without tools and the cutting unit can be exchanged quickly and easily.

Coperion also reworked the intake area, which previously used a conical construction, but the new design's straight intake feeds strands directly into the pelletizer without deflection. Intake proceeds without splits or gaps so that strand tears and bevels are avoided. Side panels on the intake roller prevent individual strands from breaking free. Coperion was also able to increase the operating width by 20 mm so that higher throughputs are now possible.

This new design also features improved soundproofing, with all motors now housed under the base plate.

Flat or Softer Prices Ahead

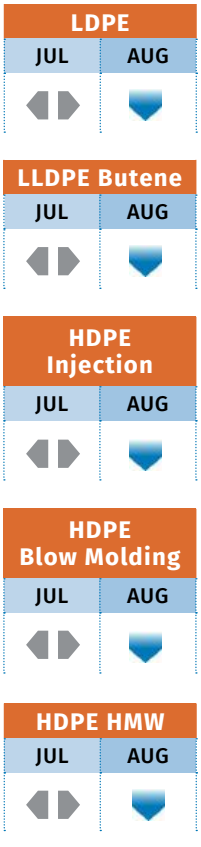
Ample resin supplies outstripping demand are likely to keep commodity resin prices flat to lower.

By Lilli Manolis Sherman
Senior Editor

Barring any major production disruptions or a spike in crude oil prices, the third quarter is likely to end with softer prices for the top five volume commodity thermoplastics. Depending on the resin, key factors include supplies outstripping demand both domestically and globally, lower feedstock costs, and lower resin prices abroad. Even in the case of PS and PVC, where prices appeared to have moved up, the trajectory was more on the downslide.

These are the views of purchasing consultants from Resin Technology, Inc. (RTi), senior editors from Houston-based *PetroChemWire* (*PCW*), and CEO Michael Greenberg of The Plastics Exchange in Chicago.

Polyethylene Price Trends



PE PRICES FLAT TO LOWER

Polyethylene prices in July were reported flat to down, while suppliers were still pushing for a 3¢/lb price increase. Mike Burns, RTi's v.p. of PE markets, reported that PE suppliers denied there were contract prime price decreases in June, as had been projected by industry analysts, despite record PE inventories. And The Plastic Exchange's Greenberg said, "Although a 3¢/lb contract price increase is on the table for July, an official decrease seems more likely for those that did not *already* receive relief in June. Spot prices are just too weak and discounts are too large to justify an increase at this time, and a 3¢/lb decrease would just wipe away the surprise increase that took hold in April."

PCW senior editor David Barry reported that PE spot prices were flat to lower as supply continued to outstrip demand. "With corporate earnings season in full swing, suppliers were touting strong PE export growth, especially to Asia, and expectations of continued low and stable feedstock costs in North America. The domestic market was sluggish, although it was unclear how much was due to the usual seasonal trend and how much was due to slower economic growth. Export channels continued to see abundant offers but tepid international demand, with some export buyers calling for lower prices in August." All three sources generally conceded that prices in August to September were unlikely to change from a flat-to-lower trajectory.

Burns noted that processors were starting to build their inventories heading into the fall season. Off-grade resin prices were at near a 10-year low, with HDPE and LLDPE prices below 40¢/lb. Similarly, export prices for August were 1¢/lb lower than in July. Still, he noted several factors that may keep PE prices flat into the late fall, including demand for exports from Southeast Asia for its agricultural season, domestic demand for packaging for the upcoming holiday season, weather, oil-price increases, and "supplier determination to maintain margins."

Market Prices Effective Mid-August 2019

Resin Grade	¢/lb
POLYETHYLENE (railcar)	
LDPE, LINER	98-100
LLDPE BUTENE, FILM	81-83
NYMEX 'FINANCIAL' FUTURES	34
AUGUST	34
HDPE, G-P INJECTION	103-105
HDPE, BLOW MOLDING	96-98
NYMEX 'FINANCIAL' FUTURES	35
AUGUST	35
HDPE, HMW FILM	110-112
POLYPROPYLENE (railcar)	
G-P HOMOPOLYMER, INJECTION	69-71
NYMEX 'FINANCIAL' FUTURES	44
AUGUST	44
IMPACT COPOLYMER	71-73
POLYSTYRENE (railcar)	
G-P CRYSTAL	109-111
HIPS	113-115
PVC RESIN (railcar)	
G-P HOMOPOLYMER	83-85
PIPE GRADE	82-84
PET (truckload)	
U.S. BOTTLE GRADE	52-55

PP PRICES SOFTER

Polypropylene prices in July increased by 0.5¢/lb, decoupling for the first time in a couple of years from propylene monomer con-

tracts, which settled 1.5¢/lb higher, according to Scott Newell, RTi's v.p. of PP markets, *PCW*'s David Barry, and The Plastic Exchange's Greenberg.

Polypropylene Price Trends

Homopolymer	
JUL	AUG
▲ 0.5¢/lb	◀▶

Copolymer	
JUL	AUG
▲ 0.5¢/lb	◀▶

Noting that the major industry indices showed a 1¢/lb erosion of PP prices in July, Newell added that the industry had not seen any decrease in suppliers' margins since 2015. Generally, these sources expect PP prices to hover 1-2¢/lb higher or lower, with potential for more supplier margin erosion before year's end.

Both Barry and Greenberg observed a very active spot PP market with abundant supply, especially for homopolymer. "We are seeing some great deals out there and buyers clearly agree, as a sustained flurry of railcars and truckloads have been changing hands through our marketplace," reported Greenberg.

Barry noted that spot prices of PP homopolymer were 4-7¢/lb lower than prime PP prices, while Newell reported a difference of as much as 5-10¢/lb in some cases. Said Newell, "Demand for PP continues to disappoint. June demand was off quite a bit, with a 66-million-lb supplier inventory buildup and a comfortable 36.7 days of inventory. Industry sentiment for July was that demand had not shown much life. We're back to a well-supplied market." Newell noted that because of lackluster demand and anticipated capacity increases next year, some suppliers are going after market share with competitive pricing while others are trying to maintain market share by reducing operating rates to below 90%.

PS PRICES UP FOR NOW

Polystyrene prices appeared to be moving up 2¢/lb at the end of July as suppliers pushed to implement a 3¢/lb increase, according to both *PCW*'s Barry and Robin Chesshier, RTi's v.p. of PE, PS and nylon 6 markets. They noted that the move was in step with July benzene contracts settling 33¢/gal higher at $2.67/gal. Every 10¢/gal move in benzene equates to 1¢/lb in the production of PS, noted Barry, who also reported that supply was abundant, with PS demand off as more and more companies look to shift to alternative resins, particularly for packaging.

Polystyrene Price Trends

GPPS	
JUL	AUG
▲ 2¢/lb	◀▶

HIPS	
JUL	AUG
▲ 2¢/lb	◀▶

Added Chesshier, "While suppliers have some legitimacy for this increase, buyers are pushing back hard because they feel they ought to have gotten back 2¢ of the 4¢/lb April increase, which suppliers attributed half to benzene increases and half to flooding." She noted that all industry indices show both production and demand down; that ethylene prices are at record lows; and butadiene prices, affecting HIPS grades, have also dropped. Both sources expected PS prices in August and September, barring any major disruptions, to be flat to lower.

PVC PRICES UP

PVC prices for June were unresolved nearing the end of July, after remaining flat through May and June. *PCW* senior editor Donna Todd reported that June contract resin prices appeared to be settling 2¢/lb higher, as suppliers pushed to implement their June increase. "The rationale behind the price bump was that planned and unplanned downtime this year had caused a significant drawdown of producer inventories, meaning supply has not kept up with demand. However, converters said they were not seeing a big increase in domestic demand this year."

PVC Price Trends

Pipe	
JUL	AUG
▲ 1-2¢/lb	▼

Gen. Purpose	
JUL	AUG
▲ 1-2¢/lb	▼

Mark Kallman, RTi's v.p. of PVC and engineering resins, noted that July prices would be flat and August was likely to see at least 1¢/lb trimmed from the already implemented price hike. "By July, production issues had been resolved and output was up while demand fell." He noted that the construction market had not been as strong as had been expected and export prices had also dropped. Ethylene monomer dropped a bit more in June and was expected to be flat. "Suppliers had a good first half of the year with record low ethylene prices that increased their margins." He ventured that September PVC prices could be flat to down if the global market softened further.

PET PRICES DOWN

PET resin prices—both domestic and imports—hovered in the low-to-mid 50s, driven by a global glut, reported *PCW* senior editor Xavier Cronin. He noted that July ended with PET prices at 52-55¢/lb delivered to locations east of the Rockies and ports in California. Cronin ventured that PET prices in August would stagnate at these levels.

PET Price Trends

Bottle Grade	
JUL	AUG
◀▶	◀▶

Typically, PET prices rise in summer due to robust consumption of single-use PET bottles for carbonated beverages, water and other drinks. Cronin reported that PET resin imports in the first five months of 2019 were actually down 10.6% from Jan.-May 2018 (mainly on a plunge in imports from the top source, Mexico), but U.S. supply is still robust due to domestic production and competitively priced imports from Asia and the Mid-East.

Processors Report Lower Orders and Production

July Plastics Processing Index dips to 46.1.

By Michael Guckes
Chief Economist/Director of Analytics

Plastics processing activity changed course sharply in July, as the Gardner Business Index (GBI) registered 46.1. (Index readings above 50 indicate expanding activity while values below 50 indicate contracting activity. The farther away a reading is from 50, the greater the change in activity.)

Analysis of the underlying components of the Plastics Processing Index reveals that employment, new orders and production contracted at rates not seen in nearly three years. Other than supplier deliveries—considered a lagging indicator—all components contracted.

In general, new orders and production are more sensitive indicators of economic activity change, while supplier deliveries and employment are often lagging components of the Index. During the 2015-2016 slowdown, new orders and production began contracting five months prior to supplier deliveries. Surprisingly, employment in July contracted nearly simultaneously with the initial contraction in new orders.

Plastics Technology's Custom Processors Index also contracted, registering 46.3 in July. Here, too, five of the six Index components contracted during the month. Custom processors indicated a steeper contraction in production, compared with the overall plastics processing industry. This more aggressive production contraction likely explains the weaker supplier deliveries among custom processors but slightly higher backlogs.

Gardner Business' Plastics Processing Index is based on responses to surveys of subscribers to *Plastics Technology* Magazine.

Michael Guckes is chief economist and director of analytics for Gardner Intelligence, a division of Gardner Business Media, Cincinnati. He has performed economic analysis, modeling, and forecasting work for more than 20 years among a wide range of industries. He received his BA in political science and economics from Kenyon College and his MBA from Ohio State University. Contact: *(513) 527-8800; mguckes@gardnerweb.com*. Learn more about the plastics processing Index at *gardnerintelligence.com*.

Gardner Business Index: Plastics Processing

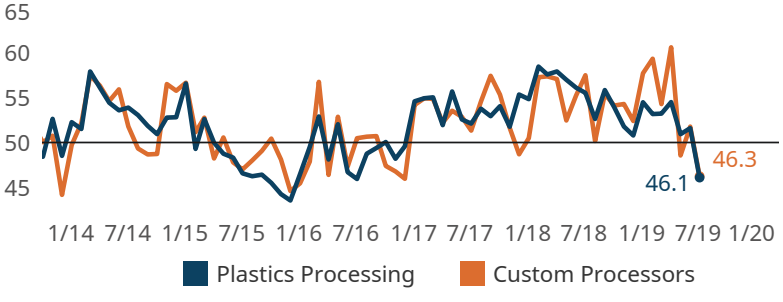


FIG 1

The Plastics Processing Index contracted for the second time in three months. The latest reading is a multi-year low for the Index.

Plastics Processing New Orders by Company Size

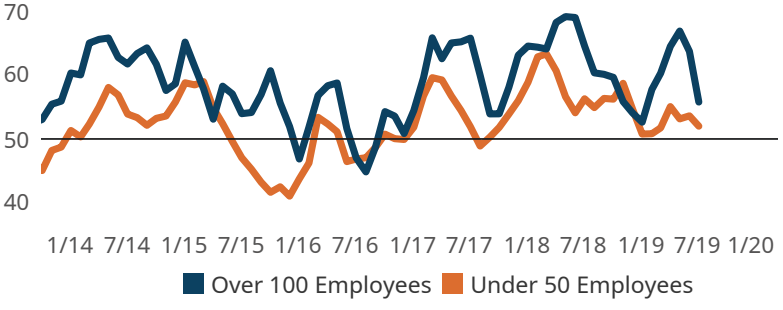


FIG 2

July new-orders data for firms of all sizes was worse than in prior periods. According to our data, large firms are no longer enjoying the new-orders advantages their size has offered them over the last three years.

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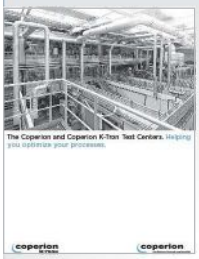

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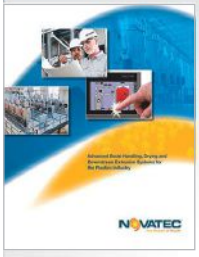

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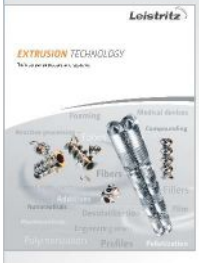

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XCENTRIC MOLD & ENGINEERING — CLINTON TOWNSHIP, MICH.

Speed and Flexibility Help Molder/Moldmaker Fill a Niche in Product Development

Quotes in hours, parts and molds in days—Xcentric Mold & Engineering brings prototype speed to production molding and moldmaking.

By Tony Deligio
Senior Editor

Brothers Brendan and Damon Weaver grew up in moldmaking, their father a tool builder himself. When they branched into injection molding 22 years ago, founding Xcentric Mold & Engineering in Clinton Township, Mich., they sought maximum efficiency in both areas, according to Xcentric's current CEO, Michael Rynerson. They asked themselves, "How do we make a company function as well as possible and be as profitable as possible?".

"A lot of it has come down to information management rather than actual making of the molds," Rynerson says. "They were already very good at making molds, so it became, 'How do I make this efficient?'".

Today, Xcentric's promise to customers, who range from designers and inventors to OEMs, is quotes in hours and molds and parts in days. Part runs can range from 25 to the thousands. Proprietary software and "tribal knowledge" accelerate quoting, machining and molding. Rynerson says Xcentric's appeal is the ability to bring speed and agility to various portions of the product-design cycle.

Xcentric's Clinton Township facility covers more than 30,000 ft² with a moldmaking space consisting of nine CNCs (3- and 5-axis), as well as two EDMs.

From ideation and virtual design; through virtual and physical prototyping; and finally into pre-production, production and validation, Xcentric shepherds products from concept to consumption with haste. "We have the luxury, if you will, of being effective in several of those areas from the time that part goes into physical prototyping all the way through production," Rynerson says. "We understand that Xcentric serves a very important function in the complete product-development cycle for our clients."

Rynerson came on board in November 2018 following investment in the company by private-equity firm Riverside Co. Since that time, Xcentric has shifted its strategy. "We're transitioning into becoming active earlier and earlier in the product-development cycle of our clients," Rynerson says, "understanding their needs for that specific product cycle and then performing a service as needed along the way."

The company has two facilities, having opened a second operation in Shelby Township in 2016 that is 5000 ft² larger than its original site in Clinton Township. Both offer high-speed CNC and EDM machining, additive manufacturing and injection molding, with 33 presses from 55 to 385 tons in an all-electric fleet comprised of JSW and Milacron-Fanuc Roboshot machines.

The machining department takes a CAD design, and through a series of macros and customizations to its CAM software, finalizes a tool design and milling path. All molds utilize standardized, proprietary base sizes, helping streamline fabrication; and all molds are cut from aluminum, further shortening build time. Production tools, new and existing, are prepped for molding by the assembly department, which passes a mold about to go into production to the "Process Lab." There, four Roboshot machines sitting in front of the JSW production presses are used to dial in the tool and process before they're released to the production floor. What happens next is "like a ballet," according to Rynerson, as mold, material (dried in advance) and machine come together for a part run.

"So it's like a production line at a factory," Rynerson says. "These 10 activities have to happen beforehand in order for me to take my step. They are all completed; they're scheduled appropriately; so they line up consistently at that point. That's the heart of what makes us so successful and able to scale with a high degree of complexity and variability in the process, literally day to day." PT

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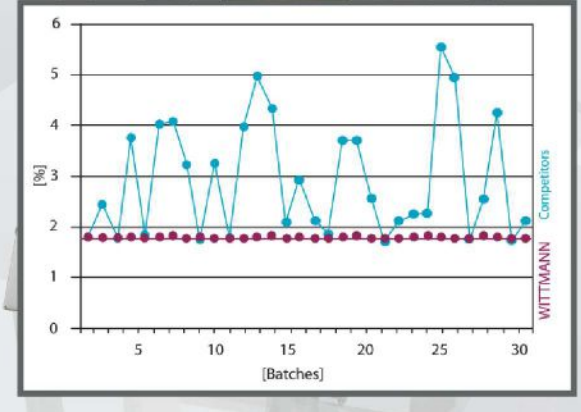

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