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CONTENTS

VOLUME 64 • NUMBER 06

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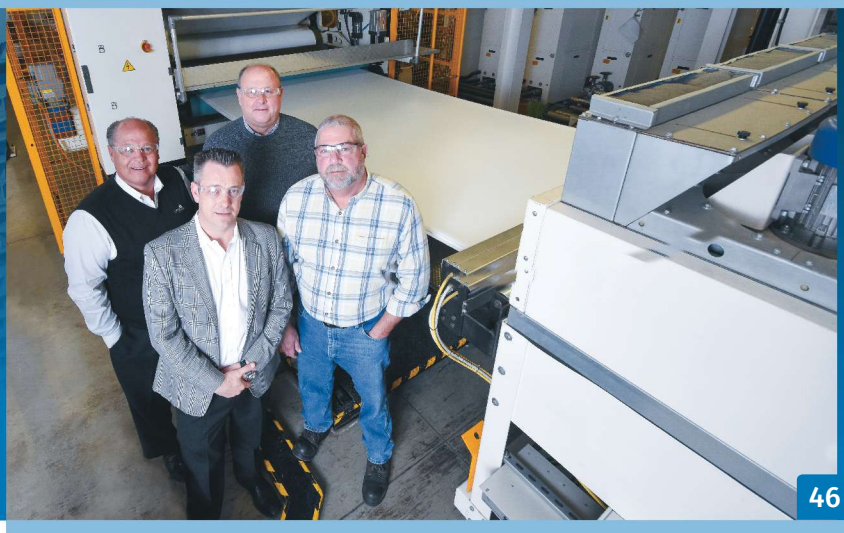


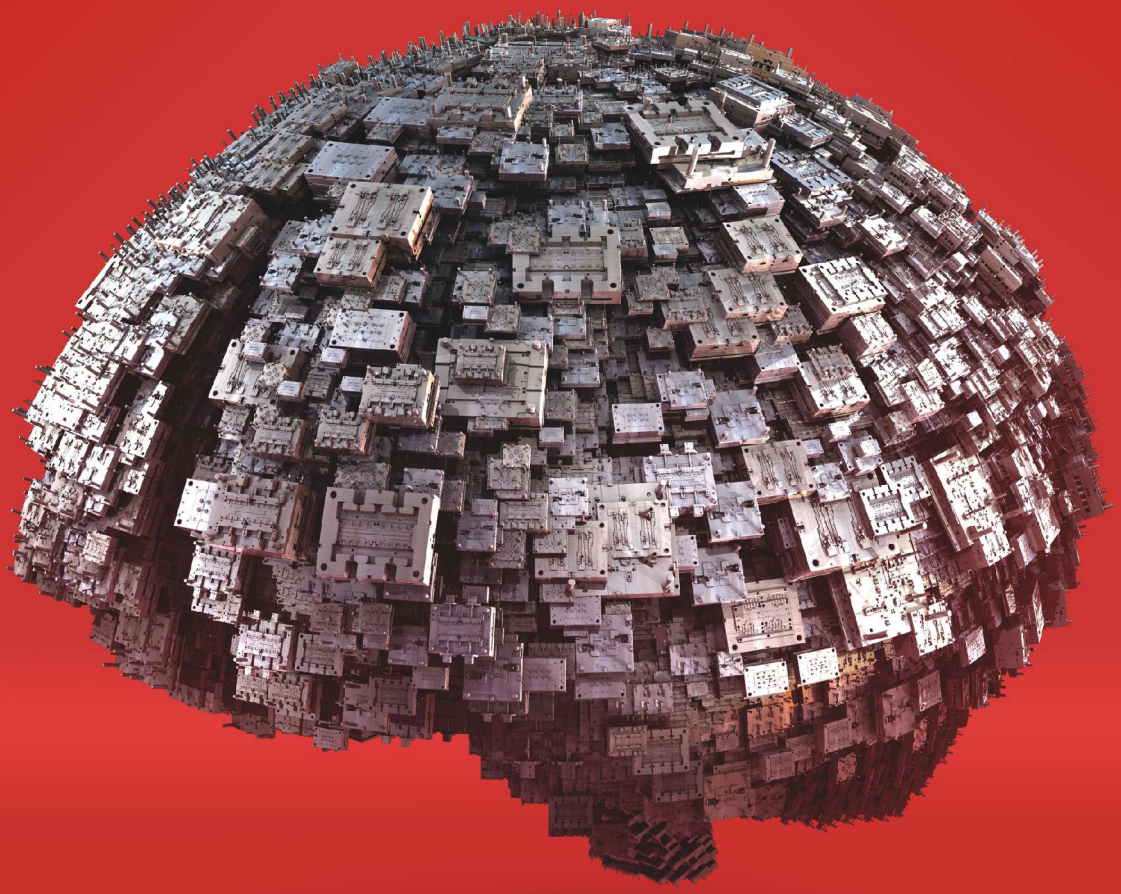
On-Site

The One Company Solution

Primex has vertically integrated its color compounding, sheet extrusion, and fabrication businesses to provide a single-source solution to customers in a wide range of industries.

By Jim Callari,
Editorial Director

Photos: Len Kaltman, West Chester Corporate Photography



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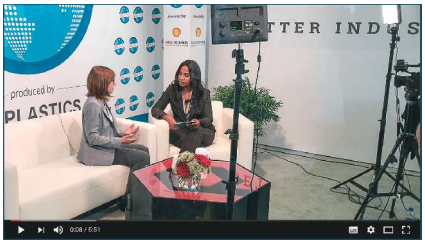
NPE on TV

Produced by the Plastics Industry Association and sponsored by Shell Polymers, the NPE Network was a new wrinkle at NPE2018. Produced on-site with on-the-floor videos and on-set segments from



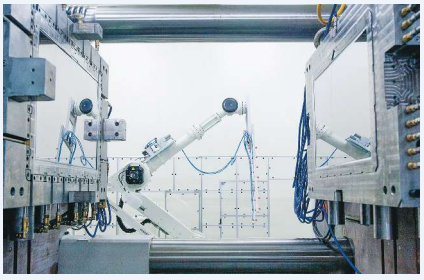
the Live Studio, NPE Network features discussions with leading plastics industry figures, including editors from *Plastics Technology* and other Gardner Business Media brands. Pictured above left is Stephanie Hendrixson, senior editor of sister publication *Additive Manufacturing*. If you didn't make it to Orlando, get a feel for the show by tuning in.
npenetwork.com

BLOG: Say Good Bye To Bike Flats

Plastics Technology Senior Editor Heather Caliendo checks in with BigRep, a German manufacturer of 3D printing equipment, which utilized its machine—and its own TPU-based filament—to print a never-flat bicycle tire. Tested on the streets of Berlin, the tire uses a three- layer honeycomb structure to withstand the rigors of city biking.
bit.ly/2L0SCkN

BLOG: Adding Robots and People in Germany

Automating a shop floor is often perceived as a zero-sum game for a plant's employees: Adding robots means subtracting people. A new study from Germany however, promoted by the International Federation of Robotics, notes that as that country mechanizes its factories, it's also increasing the number of people working in manufacturing.
bit.ly/2wNJe0D



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The Pellets Have Returned, Too

Materials suppliers came back to NPE2018 in a big way last month.

Jim Callari
Editorial Director

NPE2012—the first year the triennial trade show was held in Orlando—was promoted as "The Return of the Machines" in the months leading up to the show. And that turned out to be prophetic, as machine builders brought lots more equipment to the exhibit floor than they did in the scaled-back NPE2009. The trend continued at NPE2015; and at last month's NPE2018, there were a reported 2 million more pounds of equipment on the floor than at any previous NPE. Wow. And quite a bit of that machinery and equipment was humming and buzzing all week long. Great news for our industry indeed.

But as I made my way from the West Building, where most of the machinery companies were exhibiting, toward the South Building of the giant Orange County Convention Center, I was struck by something I consider equally impressive: large exhibits belonging to materials companies, many of whom over the years had scaled back if not altogether dropped their presence at NPE (but, notably, not at Chinaplas nor the K Show in Dusseldorf). I mentioned my observation to Matt Naitove, executive editor of *Plastics Technology* magazine. You see, Matt knows a thing or two about NPEs: 2018 marked his 16th show (I've been to 10). He quipped, "Well, I guess the pellets have returned too."

Photo: Primex; Len Kaltman, West Chester Corporate Photography

While not as grizzled as Matt, I've been around in plastics journalism since 1988. When I started, the materials companies were the primary newsmakers in the industry. Quite a few would hold annual press conferences touting new materials and applications. Others would regularly invite the plastics media to attend their facilities for open houses and other such news-making events. For sure, there were significant developments in machinery as well, but the big breakthroughs were in materials.

> ***Isn't it best to keep both links in the plastics manufacturing chain—processors and OEMs—well lubricated?***

Then things started to slow down. Suppliers of engineering resins seemed less interested in communicating news of their developments to processors—our core audience—and keener on talking to designers at OEMs. The OEM designers are important for certain, but isn't it best to keep both links in the plastics manufacturing chain well lubricated? And suppliers of polyolefins? Well, I remember a conversation I had on this matter in the mid-90s with a mid-level manager at a major polyolefin supplier, and that person opined, "Our material is the same as that company's, and that company's, and that other company's too. What's there to talk about? What's there to market? We just want our people selling it." Obviously, that was this exec's way of expressing the commoditization of PE and PP.

Was that person right or wrong? Perhaps it may have been a correct assessment at the time, but the winds of change have shifted. Perhaps plant expansions driven by inexpensive feedstocks like shale gas are one reason. Maybe—as some major suppliers have predicted—processors from abroad are looking to establish a manufacturing footprint in the North American market. In any event, I see more news coming from materials companies—and not just on exotic engineering thermoplastics but on bread-and-butter polyolefins as well—than I remember seeing in a long time. And not just about resin, but about additives that when dosed teach the base material new tricks. So-called commodity polymers are indeed being *engineered* to accommodate a marketplace that is demanding better performance and more speed.

I think it's in the best interest of our industry that materials suppliers communicate up and down the manufacturing chain. Processors may not always buy the material—lots of times the bigger OEMs do the negotiating to take advantage of their economies of scale—but for certain it's always being run through their machines. I'm hoping what I saw at NPE2018 is a sign of things to come. PT

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Major New Injection Molding Group Emerges

In just seven months, an integrated group of injection molding, prototyping, and moldmaking companies with six operations from coast to coast, over 200 injection machines from 28 to 1000 tons, and nearly 1000 employees has emerged through a series of strategic acquisitions. The new holding company behind this burst of activity is called Westfall Technik, based in Chandler, Ariz., and founded last year by former Nypro CEO Brian Jones. Its managing director is Rick Shaffer, a plastics industry veteran with previous posts at Beloit, Demag, Van Dorn Demag, and Netstal. The firm is backed by two New York-based private-equity firms, Lee Equity Partners and Blackbern Partners.

Between last October and this past May, Westfall took what the firm describes as "the first steps in the realization of a vision to build a market-leading group of plastics experts whose combined synergies and integrated network provides optimum engineered solutions throughout the plastics manufacturing process." Westfall Technik plans to continue to grow through acquisitions and internal, "organic" growth. The company's ambitions are reflected in referring to itself as a "global holding company."

Its website (***westfall-technik.com***) states that the firm aims to provide "high-end manufacturing solutions" for the medical, packaging, and consumer-goods industries "through selective juggling of specific core competencies" and a focus on automated systems and high-performance, all-electric injection machines. The company also claims to offer "effective Industry 4.0 concepts" and "unique barrier and IML technology," as well as cavity-specific sorting, OEE optimization, RFID labeling, and "seamless tracking."

The firm launched itself into production operations with the acquisitions last October of Fairway Injection Molds Inc., a moldmaker in Walnut, Calif.; and Integrity Mold Inc., a full-service injection molder in Tempe, Ariz. That was followed in February by the addition of two prototyping and short-run molding businesses—10 Day Parts Inc. (formerly known as Advanced Technology Inc.), Corona, Calif.; and Elfy's Inc., Hayward, Calif. In March, Westfall Technik purchased AMS Plastics Inc., a medical-oriented injection molder in El Cajon, Calif., with molding operations in Tijuana, Mexico. April brought the acquisition of AMA Plastics Inc., a fairly large injection molder in Riverside, Calif. And the group expanded to the East Coast with May's addition of NPI Medical Inc., Ansonia, Conn. Also in May, Westfall purchased an Arburg freeformer 3D printer. (Photo: Rick Shaffer with a freeformer at NPE2018.)

Carolina Color Gets Patent for Versatile New Technology

The U.S. Patent and Trademark Office recently issued a patent to Carolina Color Corp., Salisbury, N.C., for the company's G3 color pellet technology—a further upgrade from its popular G2 technology. The G3 technology reportedly has proven effective in diverse applications such as packaging, housewares, and lawn and garden. Among its key attributes are said to be versatility in just about any resin system and ability to achieve 20% or more increased pigment loading levels in PE and PP without compromising dispersion. It has also been shown to enable formulations with 40-45% loading of dyes in HIPS, PET, nylon, crystal PS and acrylic. Also claimed are formulations with 50% or more pearlescent pigment, versus the former industry standard of 30%.

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Chilling Combination: Frigel Acquires Green Box

Two Italian makers of process-cooling equipment have combined, with Frigel Firenze SpA of Florence acquiring Padua's Green Box Srl in a deal announced last month at NPE2018. Frigel CEO Orindo Dorin (photo, left) said the acquisition is complementary for his company, giving it product lines it previously didn't offer, including cooling, sorting and inspection systems for closure production, as well as mold dehumidifiers, rapid mold-heating/cooling technology, and temperature controls for die casting.

Frigel had two booths at NPE2018, with the South Hall booth located in the bottle zone and featuring a cap-cooling line from Green Box. Al Fosco (photo, right), marketing manager of the company's U.S. subsidiary, Frigel North America Inc., East Dundee, Ill., said that the combined companies also have had complementary sales structures. Green Box has strong penetration in the OEM market but little-to-no North American presence, while Frigel has strong representation in North America but minimal OEM input.

Dorin says there is some technology overlap between the companies in chillers, which will be harmonized eventually into a single line. The company will retain Green Box's 13,000-ft^2 factory in Padua, adding its capacity to Frigel's 30,000 ft^2 site in Florence. Frigel also has production in Thailand and Brazil, as well as Milan, Italy, which makes cooling systems for industries beyond plastics. Green Box has 75 employees.

Just prior to NPE2018, Frigel also announced a partnership with Matsui Technologies India Ltd. The 50:50 joint venture, called Frigel Intelligent Cooling Systems India Private Ltd., will see Frigel manufacture there its line of Ecodry 3DK fluid coolers and Microgel RCS water-cooled chillers and temperature control units.

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Microsoft Taps MachineSense for Startup 'Accelerator' Program

Technology behemoth Microsoft has selected 12 startups in its ScaleUp program, formerly known as Microsoft Accelerator. Among them is MachineSense of Baltimore, which provides predictive-maintenance and analytics technology for plastics processing and other industrial machinery, components, and infrastructure systems.

Microsoft plans to invest more than $500 million over the next two years to help these startups with go-to-market strategies, technology and community building. ScaleUp focuses on late-stage B2B startups and helps them accelerate their business with mentorship and business development. No cash is involved. Microsoft has also announced a $5 billion funding effort to establish itself strongly in the Industrial Internet of Things security and programs.

The 12 startups—winnowed from a list of thousands—will be brought into the Microsoft Azure Ecosystem so that their products and intellectual properties can be part of the Microsoft program to facilitate integration and device security. After that, there is a "co-seller program" between the start-ups and Microsoft in which Microsoft customer-service teams work with the start-up to identify opportunities with key Microsoft customers and close sales jointly.

Each startup receives four to six months of Microsoft ecosystem innovation and entrepreneurship resources. Microsoft gives the selected companies access to its major clients, which provide a full range of market support, promote industry solutions with Microsoft Azure, and help companies make new connections.

MachineSense is one of two U.S. companies among the dozen selected by Microsoft, and the only one with a position in plastics. Says Conrad Bessemer, CEO of MachineSense and Novatec, "One key differentiator that attracted Microsoft to MachineSense is the ability to provide a complete solution. MachineSense will be the first in the Azure Ecosystem to merge hardware, highly refined data statistics, and advanced analytics that can be applied to a range of devices right out of the box."

Bessemer adds, "With the alignment within the Microsoft Ecosystem and the existing partnership with Siemens' Mindsphere Industrial platform, MachineSense is now positioned as the most secure and accepted predictive-maintenance system in the market today. Microsoft has been pioneering advanced security systems for industrial devices, and MachineSense will be the only predictive-maintenance system to benefit from this platform to date. This will assure the highest level of data security and protection for industrial clients, not only backed by MachineSense but by Microsoft and Siemens."

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SABIC & ExxonMobil Form New PE Venture

A major olefins project, first announced in 2016 and pending completion of the environmental-permitting process, has been firmed up by Houston-based SABIC (***sabic.com***) and ExxonMobil Chemical (***exxonmobilchemical.com***) through the formation of a new joint venture.

Development of the new Gulf Coast Growth Ventures project, currently planned for construction in San Patricio County, Texas, starts with a 3.6 billion lb ethane cracker and will also include two PE production units and a monoethylene glycol plant. No further details, such as capacity or types of PE grades, are available, though it's very likely it will include all three types—L/LLDPE and HDPE. The plant is expected to be operational in the 2021 or 2022. This will be SABIC's first polyolefin production in North America, though it is a major producer in the Middle East.

Recycler-Compounder Gets Fast ROI from Melt-Filter Upgrade

CTC Plastics says a recent switch from old slide-plate screen changers to Ettlinger's new ERF 350 continuous self-cleaning screen changer paid for itself in roughly nine months by reducing downtime. The firm runs five compounding lines in 100,000 ft² of manufacturing space in Dayton, Ohio, focusing on reprocessing PP primarily for resale to automotive and other applications. Launched in 1994, CTC (***ctcplastics.com***) also has custom and captive compression molding capabilities. For recycling, it had been using dual-belt, slide-plate screen changers.

"The technology we had required us to change screens every 30 seconds," says Mike DeMatto, CTC's president and COO. "We had inconsistent material flow due to the fact that polymer was wrapping around the blades of the screen changers, and on average we were down 12 hours a day."

In the ERF series from Ettlinger (now part of Maag and based in Tyrone, Ga.), melt flows from the outside to the inside of a servo-driven filter screen with a large number of conical holes. The contaminants contained in the melt remain on the filter surface; they are removed from the screen by a scraper after one rotation, then discharged from the process directly by the discharge shaft. As a result, a clean filter surface is available after each screen rotation.

From left, CTC Plastics' Carlos Perez, plant manager; Vishal Soin, CEO; Jeff Cartmell, dir. of operations; Mike DeMatto, president & COO; and Mike Diletti, managing director, Ettlinger North America LP.

CTC has two ERF 350s running, with one more on order. DeMatto says the screens now need to be changed only once a month and help the compounder produce material with near-virgin properties.

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Chinaplas 2018 Sets Attendance & Space Records at New Venue

More than 180,000 attendees turned out for the four days of Chinaplas 2018 at its new venue, with more than 26% of those coming from outside China. Held April 24-27 at the National Exhibition and Convention Center (NECC) in Shanghai, Chinaplas 2018 saw 180,701 attendees pass through its turnstiles with 47,900 of those hailing from 150 different countries and regions, according to show organizer Adsale Exhibition Services Ltd. The show set new records for attendance—up 16.4% from last year's event in Guangzhou—and in exhibit space.

In terms of gross hall floor area, the NECC trails only Germany's Hannover Exhibition Center in size globally. Chinaplas 2018 surpassed the most recent Chinaplas in Shanghai in 2016 by 100,000 m² (over 1 million ft²) in exhibition area. The show covered a total of 340,000 m² (3.659 million ft²). A total of 3948 exhibitors were on hand. Chinaplas will rotate to back to Guangzhou in 2019, running May 21-24.

Brand Owners Seeking Sustainable Solutions for the Circular Economy

Consumer-goods companies and brand owners are becoming a frequent presence at recycling conferences and trade shows. For instance, Dell Technologies and Procter & Gamble were among the companies at NPE2018 discussing their sustainability efforts during the Refocus Sustainability & Recycling Summit. And for good reason—there's global pressure on these companies to reduce the amount of waste in their packaging.

In 2017, The Ellen MacArthur Foundation and World Economic Forum released a report, *The New Plastics Economy: Catalyzing Action*, which aims to address global plastics issues through innovation in packaging design, recycling and delivery models. The report looks to present a path to increase global recycling rates for plastics packaging from just 14% today to 70% or more.

Six participants in the Ellen MacArthur Foundation's New Plastics Economy initiative—candy maker Mars Inc., retailer M&S (Marks & Spencer), PepsiCo, The Coca-Cola Co., consumer-goods company Unilever, and home-care products supplier Werner & Mertz—are making or reiterating commitments to use 100% reusable, recyclable or compostable packaging by 2025 at the latest.

P&G has made advances in the use of post-consumer recycled (PCR) plastics by producing packaging made partly with "ocean plastic" (marine waste—see photo). The company also partnered with PureCycle Technologies to open a plant that will restore used PP to "virgin-like" quality with a recycling method that P&G calls "one of a kind." The patented technology was created in P&G labs and then licensed to PureCycle.

"I think you are seeing durable-goods manufacturers beginning to get creative with compounding, exploring additives that can enhance properties of recycled materials," says Kim Holmes, v.p. of sustainability for the Plastics Industry Association (PLASTICS). "And brand owners like Unilever and P&G have invested in solvent-extraction technologies that eliminate colorants and other additives and can separate resins used in products like multilayer structures."

More brand owners are embracing a circular economy mindset—a plan of action that covers the entire lifecycle, from production to consumption to waste management and the market for post-consumer plastics. Research from McKinsey and Co., a global consulting firm, suggests that the global savings in materials alone could exceed $1 trillion a year by 2025, and that under the right conditions, a circular economy could become a driver of global industrial innovation, job creation, and growth for the 21st century.

"It's an exciting time in innovation and it's being directly driven by brand-owner demand to use more recycled content in a wider variety of applications," Holmes says.

Shell Chemicals Launches Shell Polymers PE

Shell Chemicals (U.S. office in Houston) has launched Shell Polymers—a new PE business dedicated to building the "unrivaled customer experience." Says Emma Lewis, Shell Polymers' general manager, "With immediate access to world-class talent, industry resources and technical knowledge, Shell Polymers aims to change the way day-to-day business in polyethylene is currently conducted." The company, which is returning to plastics production after selling off its PP business 20 years ago, is building a PE plant in Potter Township, Beaver County, Pa.

Says Lewis, "The Pennsylvania Chemicals Project will be the first Shell-operated PE production facility in company history." That world-scale petrochemical facility provides proximity to more than 70% of the North American PE market. Close to both supply and markets, the new facility will decrease economic and environmental transportation costs and provide regional plastics manufacturers with more flexibility, shorter supply chains and enhanced supply dependability, the company says. Once complete, the facility anticipates production with an average capacity of 3.3 billion lb/yr of ethylene and three PE units running LLDPE and HDPE with a combined production capacity of approximately 3.5 billion lb/yr.

A new Shell Polymers Innovation Center will be located at the site as a regional technology hub for customers. The center will consist of an analytical and materials-testing lab that will allow for close collaboration with customers to develop unique products.
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New Powerhouse Emerges In Additive Manufacturing

Jabil, an international force in manufacturing, software and services, has launched a global network of additive-manufacturing services.

By Matt Naitove
Executive Editor

Late April saw the entrance of a heavyweight amid the handful of much smaller companies staking out the new territory of industrial additive manufacturing. Jabil, a $19-billion global enterprise with around 180,000 employees and over 100 facilities in 29 countries, announced the launch of the Jabil Additive Manufacturing Network as a "digital thread" to connect its additive manufacturing operations around the world, including those at its subsidiaries Nypro and Jabil Green Point, while aligning with Jabil's software and services for supply-chain management, product development, and engineering/design.

Jabil, which operates 15,000 CNC mills along with thousands of injection machines and hundreds of automated printed-circuit assembly lines, got involved with additive manufacturing (AM) about a decade ago, using it to print metal mold components with conformal cooling, as well as assembly jigs and fixtures, for its core manufacturing operations. About three years ago, Jabil began taking AM into functional parts manufacturing.

Today, the Jabil Additive Manufacturing Network, based at Jabil headquarters in St. Petersburg, Fla., has more than 100 3D printers in around a dozen plants in the U.S. (four facilities), Mexico, China, Singapore, Hungary and Spain. Jabil's AM technologies include fused filament fabrication, polymer and metal laser sintering, and the new Multi Jet Fusion high-speed sintering process from HP. There are six HP Jet Fusion 4200 printers and six of the newest Jet Fusion 4210 models installed recently in Singapore, the newest of Jabil's AM Network sites, according to John Dulchinos, Jabil's v.p. of Digital Manufacturing.

AGILE MANUFACTURING

Jabil Additive is aiming to serve customers in markets such as footwear, industrial machinery, transportation, aerospace, and healthcare. In Jabil's view, AM might as well stand for Agile Manufacturing. A cloud-based network integrates all Jabil's 3D printers around the globe, enabling customers to move manufacturing workloads to regions and into markets that make the most business sense and enable easier product personalization. As Dulchinos puts it, "Our new Jabil Additive Manufacturing Network is the connective tissue that scales globally to integrate every printer, facility and work order across our enterprise and crystallize our vision of truly distributed manufacturing."

Dulchinos distinguishes Jabil's Network from other AM enterprises: "We're not about uploading a customer's CAD file and sending back a printed part or parts. We're about certified manufacturing processes for producing functional parts in quantities of tens of thousands."

He notes that Jabil has a product-design team in Silicon Valley, Calif., that can design a product from an initial concept, if necessary. But if the customer comes to Jabil with an existing product design, the first step is to consult with Jabil's customer content engineers to examine the customer's CAD file and perform a design-for-additive-manufacturing (DfAM) analysis.

Jabil recently installed six HP Jet Fusion 4210 3D printers in Singapore. It prints 140 parts for HP Jet Fusion printers there.

The goal is to optimize the design for 3D printing rather than injection molding or another process. That could include tweaking the design to allow multiple different components of an assembly to be printed as one part.

DfAM is followed by consideration of the AM process to be used, inspection procedures, and part qualification—as is done with injection molding or any other manufacturing method. "We are a certified manufacturer of 3D printed parts across industries, from aerospace to consumer products," he notes.

Dulchinos says AM benefits from "mold-less, fixture-less production" and the speed with which products can be put into production at any of its global facilities. "It's true Just-in-Time manufacturing. There's no need for inventory."

For example, in Singapore, Jabil uses HP Jet Fusion printers to produce 140 parts for HP's newest Jet Fusion Series 300 /500 printers—in the very same building where Jabil assembles those printers for HP. "In a single bed on the printer, we can produce a kit of multiple parts all at the same time," Dulchinos notes.

More than 100 3D printers across the globe are integrated via cloud-based production and order management.

On the other hand, he also points out three main constraints that currently limit the spread of industrial AM. "The range of materials available for AM is the biggest constraint," he states, but HP is loosening that constraint through its open materials platform that encourages thermoplastic materials suppliers to adapt their materials for HP's printers and provides guidance and other resources for doing so (see January Starting Up). The range of filament materials for AM is also growing steadily.

The second major constraint, says Dulchinos, is economics. He says the costs of 3D printing divide about evenly between material, equipment depreciation and service, and secondary processes (including labor). Today, he sees the "sweet spot" for Jabil Additive at order volumes of 10,000 to 30,000 parts. "But that's very geometry-sensitive. At the extremes, some parts may be cost-effective today in volumes up to 40,000 to 50,000 parts, and others at as few as 1000 parts." Not only is 3D printing economically competitive with injection molding at those volumes, Dulchinos says, but he believes HP's Multi Jet Fusion is "starting to approach the isotropic properties of injection molded parts—within single-digit percentages."

The third key constraint, in Dulchinos' view, is "the ability to get consistent, repeatable, parts off printers. It's not a given, but requires manufacturing rigor. That's how we got to be a certified AM manufacturer in demanding industries such as aerospace."

While AM is gradually encroaching on injection molding in low-to-mid-volume production, Dulchinos sees it as augmenting rather than cannibalizing Jabil's ample injection molding resources. It enables Jabil to offer customers new choices for optimized production efficiency. He cites the example of a medical-equipment display housing that originally required assembly of 39 injection molded plastic parts and metal fasteners. Jabil redesigned the housing as just two plastic parts that can be printed together. This display is expected to go into production this summer and the anticipated volume is in the thousands of units. PT

New Program Guarantees Performance of Auxiliary Equipment

Web-based and cloud-powered, Conair's new SmartServices platform is key to its just-launched 'Uptime Guaranteed' initiative.

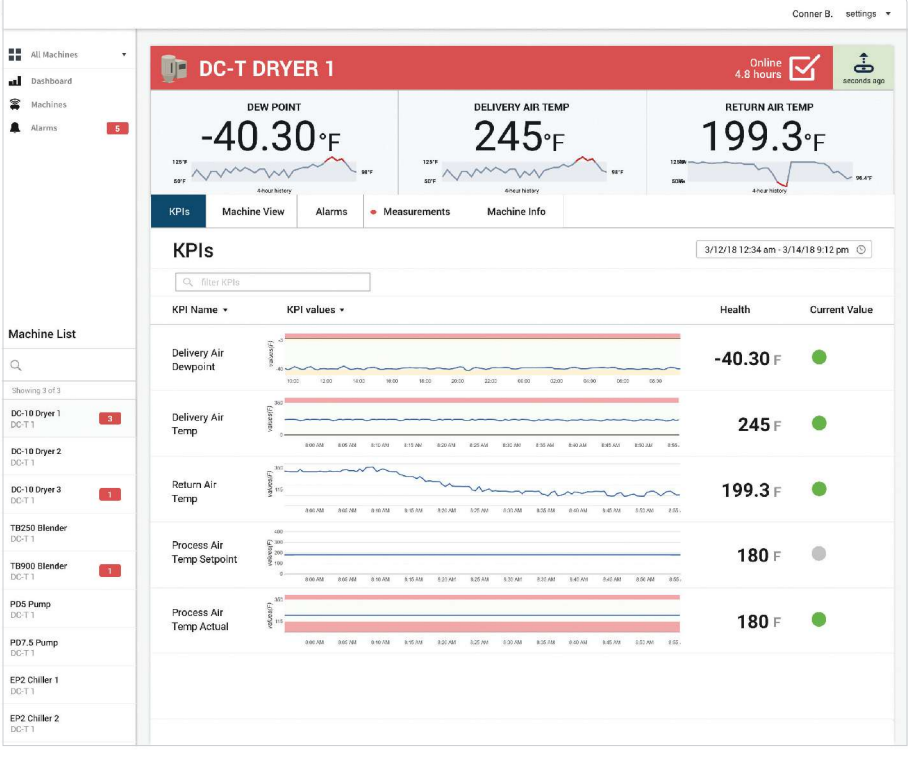
By Tony Deligio,
Senior Editor

Long-running investments in the technology it designs and builds, as well as the people and infrastructure needed to support it, coupled with new Industry 4.0 tools, have put Conair, Cranberry Township, Pa., (*conairgroup.com*), in a position where it feels it can stand unequivocally behind its equipment.

"What we think is natural is kind of a next step to this notion of 'Uptime Guaranteed,'" explains Conair president Larry Doyle. "We make a promise to our customers assuring them that our equipment will rarely, if ever, be the reason or the cause of that unintentional production stoppage." Conair unveiled its program last month at NPE2018.

"The industry has seen the evolution over the course of many years of people touting 24-hour service or parts in stock or all sorts of things to help support the customer," Doyle says. "One of the things that we've done differently over the years is put in things like a performance guarantee, where we're not just warrantying equipment but we're guaranteeing the performance of the equipment."

With Uptime Guaranteed, Doyle says Conair will be able to tell customers exactly how close to 100% uptime they can expect from their equipment, based on their process parameters and other factors. Using this data, the company can then guarantee the uptime percentage, whatever it may be. "If the equipment doesn't meet those benchmarks," Doyle says, "we will take ownership of the problem. We will fix or replace the equipment and work with our customer to make sure those uptime objectives are achieved. This is what we mean when we talk about Uptime Guaranteed."



Conair SmartServices automatically logs key performance indicators (KPI) and displays current readings (top) and trend curves over time in the middle. Users select which equipment to view in the left column and can customize the display to highlight the data they consider most important.

CLOUD-POWERED, INDUSTRY 4.0 ENABLED

Tied directly to Conair's new performance guarantee is a new cloud-based monitoring system called Conair SmartServices. Conair says SmartServices captures all of the data ►

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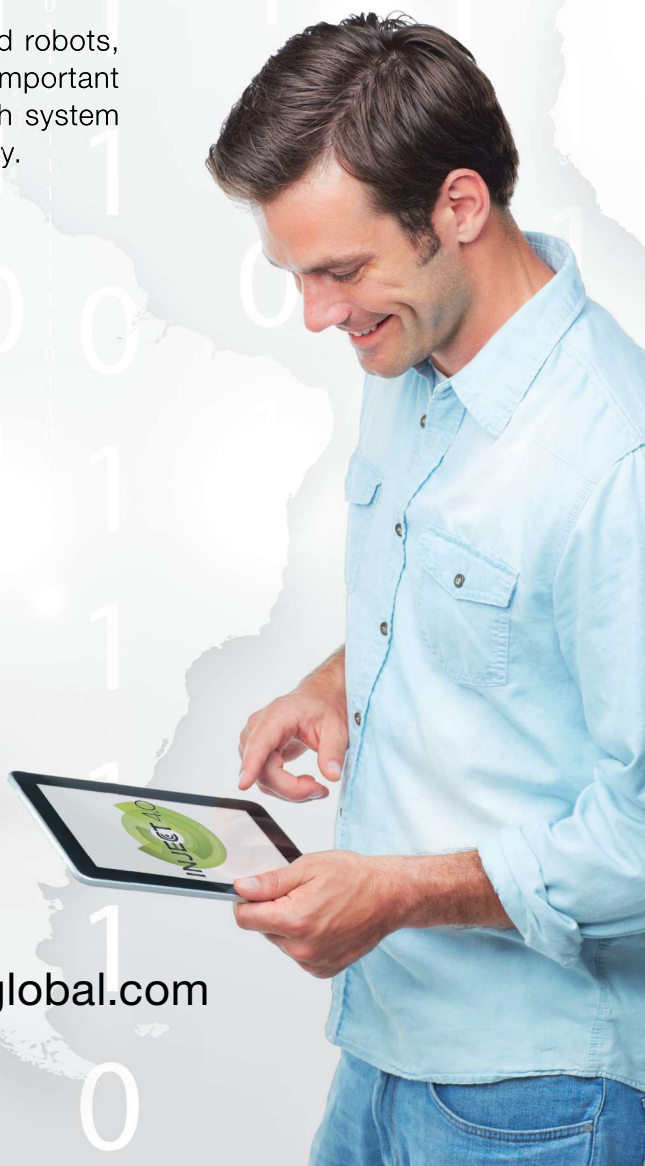

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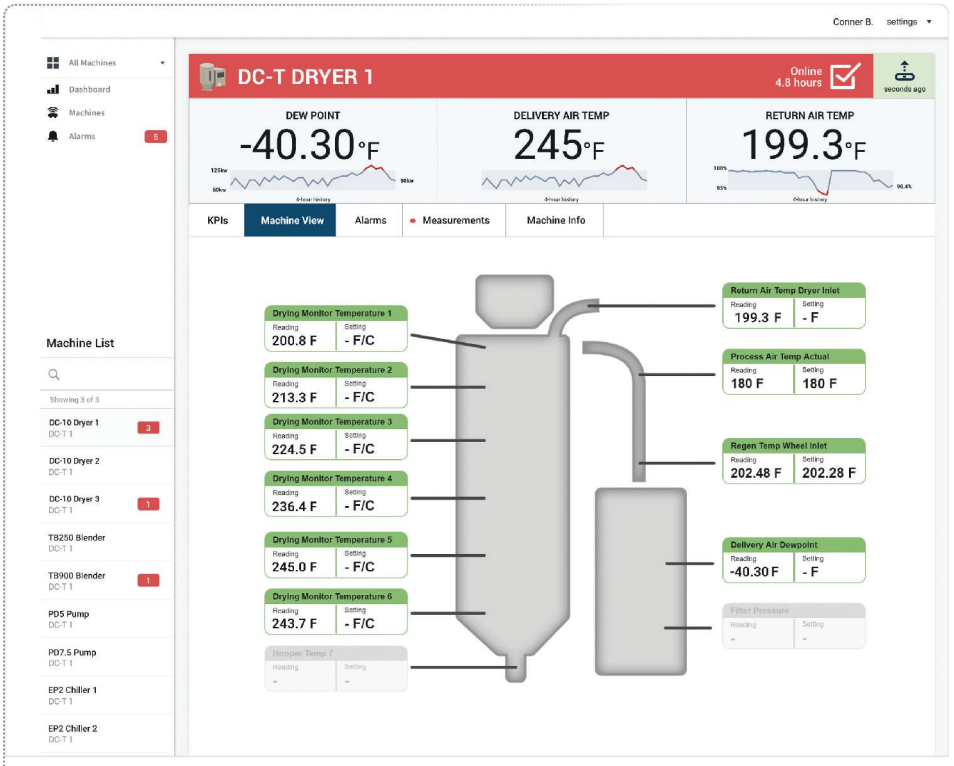

With Conair SmartServices, users can view not only key performance indicators (KPIs) at the top of this screen, but also all sensor data for any monitored equipment—a dryer in this case. Users select which equipment to view in the left column and can customize the display to highlight the data they consider most important.

generated by the controls on virtually all Conair equipment and many auxiliaries sold by other companies. A small module installed inside the equipment's control panel wirelessly transmits all that process information to a database in the cloud, where it is stored and analyzed by proprietary algorithms developed by Conair. Processors can access the information from their equipment using a web-based platform that allows them to organize data by cell, plant, product line, etc.; and companies with more than one location can track all their equipment globally or zero in on an individual site.

Doyle says the SmartServices offering will not only be sold on new equipment but can retrofitted to certain older equipment. "That will provide valuable insight into performance and monitoring of the equipment," Doyle says. "It will be able to report back out diagnostics and help us with process optimization and understanding what types of data are really indicative as to how the machine is performing."

At NPE2018, Conair had different functioning systems with live services and interactive displays to let attendees see the gathered data, as well as SmartServices dashboards, both on equipment running in Orlando but also equipment operating at customer sites and at the company's own lab. "At the end of the day, customers want our equipment running," Doyle says. "They don't want unplanned downtime because unplanned downtime equals lost productivity, which equals lost profits."

Doyle says SmartServices harnesses the data already gathered by its equipment into a format that its customers can readily exploit. "SmartServices is based on the fact that the controls of Conair equipment already gather a ton of data," Doyle says. "Right now, it resides only in the control." Going forward, after the addition of compact wireless machine adapters (WMAs), described by Doyle as being the size of two decks of cards ►

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stacked on top of one another, the control panel can then transmit data up to the cloud via the customer's own network.

"SmartServices is a cloud-based, web-based platform that is extracting data from our machine's control and then posting that data out to the cloud and doing analytics on it," Doyle says. "It is then repurposing the data into a dashboard that our customers can remotely access and monitor." Once the system is analyzing process data, it can alert, alarm, and message the processor, as well as predict potential failures.

NO-COST TRIAL AVAILABLE

The program is launching with a no-cost, six-month trial promotion, where processors can try out SmartServices in their own facility with their own equipment. Conair stresses that the program's web-based design means customers will never need to make hardware or software upgrades to have the latest version of the platform; it will be automatically upgraded on the web by Conair.

> ***"At the end of the day, customers want our equipment running. They don't want unplanned downtime because unplanned downtime equals lost productivity, which equals lost profits."***

Once the WMAs are installed and a connection is made, users can identify and configure their auxiliaries into the system, organizing them by equipment type, plant names, production lines, and physical locations. Once enabled, WMAs automatically collect data from each piece of auxiliary equipment and transmit it to the secure, cloud-based SmartServices database where it is processed and stored.

The SmartServices web portal then populates a dashboard with user data, creating a clickable list of user-specified equipment groups on one side and a large working screen on the other. Within the dashboard, users can dig into Key Performance Indicators (KPIs) for each piece of equipment.

The KPI display shows real-time data, with three items highlighted by default. Additional KPIs are shown in the form of real-time line graphs, and each one is color coded—red, yellow, or green—so users can quickly scan current operating conditions and performance trends. The Machine View display shows a schematic of the equipment overlaid with readouts of setpoint versus actual readings. On a dryer, for example, hopper-inlet air temperature, temperature gradients within the hopper, outlet air temperature, dewpoint setting, and target moisture level would be shown.

The Alarms screen displays real-time alarm status and history. A special panel allows managers to create an alarm hierarchy, and generate messages specific to each alarm type, with direct alarms sent to specific individuals or groups, depending on their type. Going further, Conair parts and service staff could be integrated into an alarm notification, enabling them to respond proactively.

Going forward, SmartServices will collect, analyze and store performance data from thousands of auxiliaries connected worldwide, creating an auxiliary-equipment database that can be leveraged by both processor and Conair personnel. PT

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New System Runs Two Molds in One Press Simultaneously

Shuttle-mold system is one of several eye-popping innovations that Canon Virginia brought to NPE2018.

By Cynthia Kustush
Senior Editor

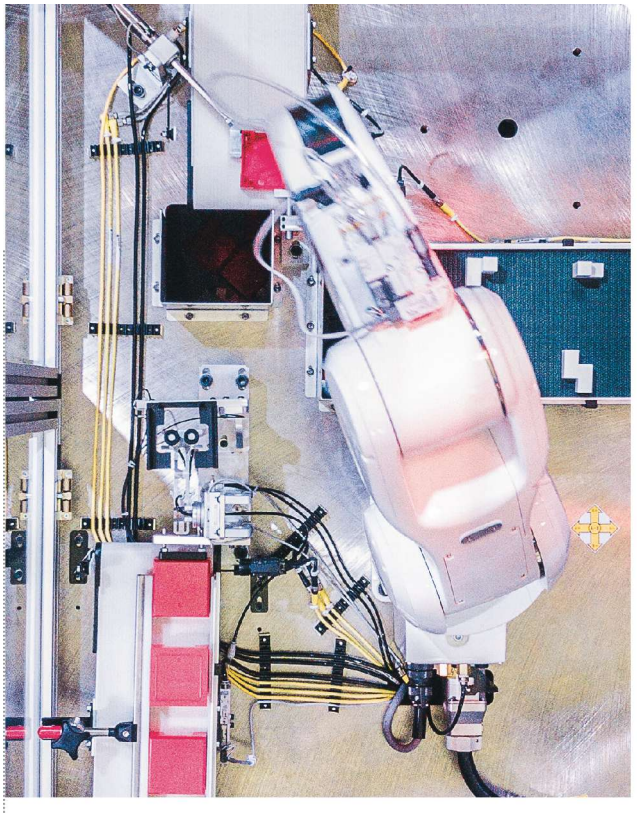
Canon Virginia Inc., Newport News, brought the wow factor to NPE2018 last month, showcasing not only its custom mold manufacturing capabilities and signature vision systems, but also a new, sleek multi-mold system, new mold-texturing technology, and a new focus on medical contract manufacturing.

Takashi Arai, v.p. of the company's Advanced Manufacturing Technology Group (***cvi.canon.com***), emphasizes the company's continual pursuit of innovation to provide customers with new and better ways to achieve efficiency in cycle time, mold changeovers and overall productivity. An example is the new multi-mold system, which runs two separate molds in one press simultaneously. NPE attendees saw the system running in a customized Sumitomo press in Canon's booth.

This is how it works: Plastic is injected into the first mold. The system then moves the first mold outside the machine's clamping area for cooling and moves the second mold into place for processing. Then the first mold returns into the machine and ejects its parts, while the second mold moves outside of the machine for cooling. The system incorporates a robot that can handle two types of parts with different shapes. This "mold shuttling" process repeats for the next cycle and so on.

This Vision Head is part of a 3D Robot Guidance System from Canon Virginia and serves as the "eyes" of industrial robots used for random bin-picking processes, improving productivity and reducing production costs.

According to Arai, this system helps transform idle cooling time into productive time by shuttling a second mold into production. Technicians can program different process conditions for each mold, like pressure, temperature, injection speed and clamp force as specified for each mold; and the system changes the parameters automatically as the molds shuttle back and forth. The proprietary process accomplishes dual, multi-product molding by the same machine without error or loss of time. ►



A drone's-eye view of one of Canon Virginia's robotic arms demonstrates the use of the company's signature vision systems on the NPE2018 show floor as parts are being automatically assembled into a box and handed out to attendees to take home.

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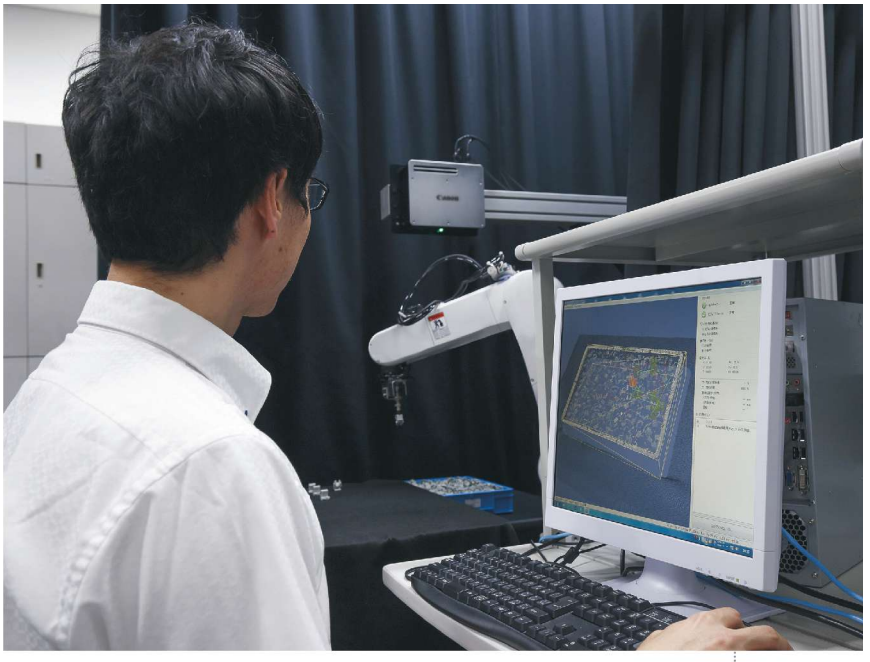

Using cutting-edge optical image recognition and data-processing technologies, Canon Virginia's RV Series 3D Robot Guidance System employs a robotic arm to quickly and accurately recognize random parts on a production line using data transmitted from the vision head.

Canon Virginia's vision systems were on display at NPE2018, including this 3D vision system. The camera "eye" snaps multiple images to quickly create a 3D image of the part.

MECHANICAL MOLD TEXTURING

Canon also introduced machined texturing for molds that can replace traditional chemical processes. Arai explained that thanks to proprietary vision technology, Canon machined texturing can reduce lead times compared with chemical processes, and improve mold life and reduce downtime and costs. "This next-generation technology creates product textures that the human eye perceives not as flat surfaces, but as patterns with tactical differentiations based on human sensory response. It creates very precise patterns with delicate features unlike chemical processes that can have wide deviations in texturing," he said.

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Finally, Canon displayed various machine vision systems, including 3D vision, in which the "eye" utilizes cutting-edge optics, image recognition and data processing to achieve three-dimensional recognition of production parts that are randomly piled in a bin and then snaps multiple images to quickly create a 3D image of the part. PT

The system helps transform idle cooling time into productive time by shuttling a second mold into production.

EDITOR'S NOTE: Cynthia Kustush is senior editor for *Moldmaking Technology Magazine*, a sister publication of *Plastics Technology*.

MATERIALS

PART 6

A Processor's Most Important Job

The importance of mold temperature to the development of the desired polymer crystalline structure becomes absolutely crucial in the case of high-performance materials.

By Mike Sepe

As we have indicated in recent articles, the rate at which semi-crystalline polymers develop their crystalline structure tends to correlate with the level of performance that the materials can achieve in the solid state. Materials like PE and PP, often considered to be commodities, crystallize readily due to their low glass-transition temperatures (Tg). The cooling rate of the material can be adjusted to change the degree of crystallinity in the molded part.

However, these changes tend to be relatively small and the longer cycle times that may be needed to manage the slower rate of heat removal may not be justified. As we move up into the semi-crystalline polymers of intermediate performance—aliphatic nylons, acetals, and polyesters—the ability of the processor to affect the degree of crystallinity becomes greater, and maintaining the correct mold temperature is more important to part performance.

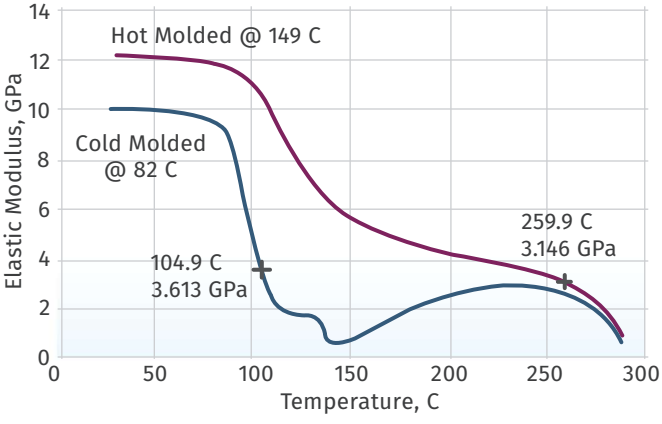
But it is in the high-performance realm, materials such as polyphthalamides, PPS, and PEEK, where the importance of mold temperature to the development of the desired structure becomes absolutely crucial, and missing the correct mold-temperature setting by even 10-15° F (5-8° C) can result in a part that falls far short of the intended performance of the material. In most cases the suppliers of these materials provide clear instructions on how the mold temperature must be set to ensure adequate crystallinity. However, occasionally a material supplier will try to let the processor off the hook and in doing so they give some very bad advice.

In our April column, we discussed the importance of maintaining a mold temperature high enough to ensure a satisfactory level of crystallization in these high-performance materials. Without exception, these mold temperatures cannot be achieved with standard water-circulating units. They require the use of hot oil, electric cartridges, or pressurized water since the required mold temperatures are in the range of 250-400 F (121-205 C), depending upon the polymer and the wall thickness of the part being molded. Many processors consider this a barrier to entry, and material suppliers want to sell resin.

Therefore, sometimes there is a mixed message in the advice coming from the suppliers. The processing community is sometimes told that full crystallization is only important if the part being molded will need to perform at temperatures above the Tg of the polymer. The reasoning goes something like this: An under-crystallized part will never experience performance problems if it is not exposed to a temperature high enough to promote the additional crystallinity that was not achieved due to quench cooling. According to this advice, the unstable state associated with incomplete crystallization will only come into play if the part becomes hot enough to undergo continued crystallization.

Unfortunately, it is not that simple. Figure 1 shows a comparison of modulus vs. temperature behavior for two specimens produced from a 40% glass fiber-reinforced PPS. The mold temperature used for the cold-molded part was 180 F (82 C) while the ►

FIG 1 **Effect of Mold Temperature on Elastic Modulus Behavior of 40% GF PPS**



Even at room temperature there is an obvious difference in the modulus of the two samples. The most important difference occurs as the two samples enter the glass-transition region. The modulus decline begins in both samples at approximately the same temperature, but the way these two samples pass through this transition is very different.

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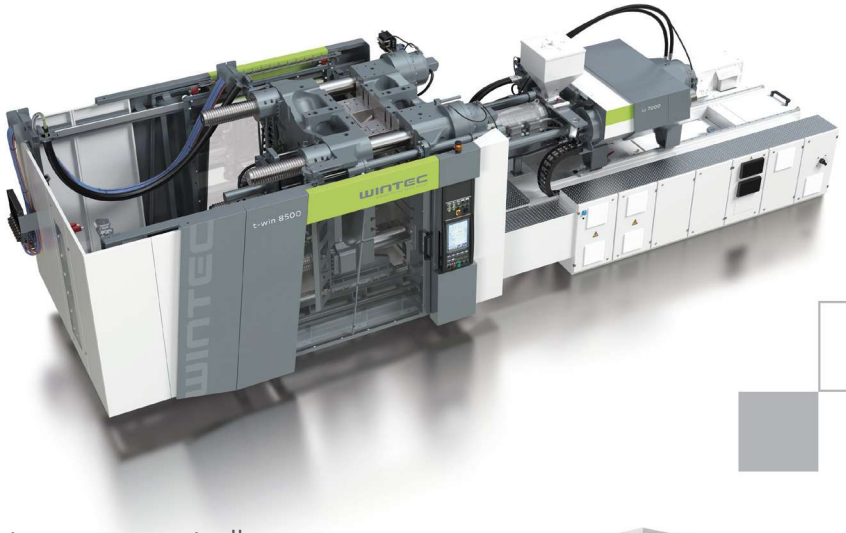

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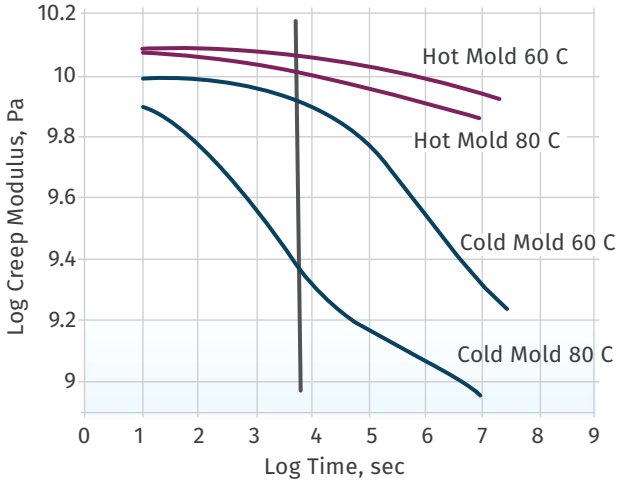
mold temperature used for the hot-molded part was 300 F (149 C). The recommended mold temperature in the processing guides for achieving optimal crystallinity is 275 F (135 C). There are some important differences in the temperature-dependent behavior of these two samples that resemble what we saw in the PPA material discussed in the April column.

First, even at room temperature there is an obvious difference in the modulus of the two samples. The part run in the cooler mold has a modulus of 10 GPa (1450 ksi) while the part run in the hotter mold is nearly 25% stiffer. But the most important difference occurs as the two samples enter the glass-transition region. The modulus decline begins in both samples at approximately the same temperature. But the way these two samples pass through this transition is very different.

The sample molded in the hotter mold exhibits a modulus decline of a little over 50% by the time the temperature reaches 302 F (150 C). It then establishes a new plateau that extends to 500 F (260 C) before displaying a second decline associated with the initial stages of crystal melting. The part produced in the cooler mold exhibits a much sharper decline in modulus that ultimately results in more than a 90% reduction in the room-temperature stiffness before the material reaches 302 F. The upward trend in the modulus beyond this point represents the

FIG 2 **Effect of Mold Temperature on Creep Performance of 40% GF PPS**



The samples run in the hotter mold show a negligible change in apparent modulus over the tested times of 4-12 months. The samples run in the cooler mold undergo very rapid changes that result in nearly an order of magnitude decline in apparent modulus over this time. The vertical line drawn through the creep curves represents the 2-hr point.

attempt of the polymer to form the crystals that should have been created during the molding process.

The logic behind the advice that optimal crystallinity does not matter if the application temperature never reaches the glass transition may appear to make sense, since the modulus of the two samples changes in a similar fashion up to a temperature of about 185 F (85 C). However, it is important to understand that the behavior of a material over time when under constant or cyclic loading will reflect the way the material responds to an increase in temperature. Consequently, the earlier and sharper decline of the modulus in the sample produced in the cooler mold will be reflected in creep tests performed at the low temperatures leading up to the glass transition.

This can be seen in Fig. 2, which shows plots of apparent modulus, sometime referred to as creep modulus, as a function of time for samples produced at both mold temperatures when tested at temperatures of 140 F (60 C) and 176 F (80 C). The differences are striking and very important to the long-term integrity of the molded part. The samples run in the hotter mold show a negligible change in apparent modulus over the tested times of 4-12 months. The samples run in the cooler mold undergo very rapid changes that result in nearly an order of magnitude decline in apparent modulus over this time frame. The vertical line drawn through the creep curves represents the 2-hr point. Even at this early stage of the tests, the differences in performance as a function of the mold temperature at which the samples were produced is evident, particularly for the tests conducted at 176 F.

These results show that any suggestion that optimal crystallinity does not matter at lower temperatures is simply misguided thinking that arises largely from the failure to take into account the full spectrum of performance as a function of temperature, time, and applied load.

We have spent a lot of time discussing crystallinity and there is a lot more that we could say. While the cooling rate controlled by the temperature of the mold is the most important variable, crystallization can be influenced by the stresses associated with pack and hold pressures, the effects of orientation, and a process known as nucleation. Crystallization is also a process that releases heat, lengthening the cycle time in unexpected ways. Next month we will close out the conversation on crystallinity with a brief review of these other factors. 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*.

INJECTION MOLDING

Process Documentation Is Crucial to Making 'Identical' Parts

Use a machine/mold setup sheet to document plastic parameters and use them on any acceptable machine into which the mold is placed.

By John Bozzelli

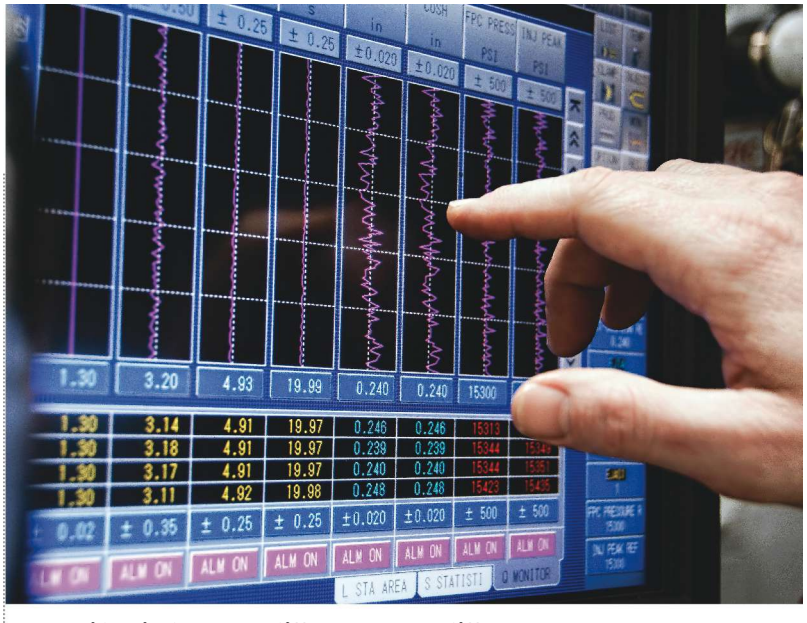
Injection molding is one of the most complex processes in manufacturing. Our industry has a common problem in setting up a molding job to make "identical" parts on every run, especially on different machines.

Defining what "identical" means depends on the application; but whatever the requirements, the goal is to make identical parts run to run, year to year, even on different machines. How we, as an 80-year-old industry, attempt to accomplish this varies and is something of a Pandora's Box. There is no general agreement on best practices. It is desperately needed, as it would enable us to compete more competitively within the world markets. Your future in the plastics industry may depend on it. Where do we begin?

There are five components to making a successful plastics application: part design; resin selection/handling; mold design/construction; processing; and testing. Each has hundreds of details and putting them together requires a trained and talented group of people. One person cannot do it all. Most likely your shop has talented people in two to four of these components. Use them for their specialty and go outside to trusted talent for those areas you do not cover or that may be new.

The goal is to make identical parts run to run, year to year, even on different machines.

I also suggest that you force a meeting with all parties before steel is cut. Few take time for this, but it will save you time and money when you find a problem *before* the metal chips fly rather than after. Plus, there are always last-minute issues that are best dealt with when all parties are present. This will aid in getting the process started on a sound footing. Then comes documentation to continue successful production.



To get identical parts on different runs on different presses, you must document and replicate the plastic process variables, not machine setpoints. (Photo: Prism Plastics)

The focus here is on processing and how to document a process that is running "good" parts so it can be reproduced from run to run, even on different machines. Documentation of the process is usually captured in what most call the "Machine/Mold Setup Sheet." Seems simple enough, but if you visited the estimated 16,000 molding shops in the U.S. you'd wind up with 16,001 different setup sheets. Even worse, there is a different setup sheet for each different press the mold goes into. And to really bring you down, it is often the case that the process changes on the same machine as shifts change.

Our grizzled processor, "Crusty Sr.," will argue that his process is better than what is currently written on the setup sheet. Processors "adjust" the process to their liking. That is the ►

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state of our industry. Here is where Scientific Molding deviates from the crowd: You use only one setup sheet per mold—not a setup sheet per press. Document the *plastic* (not *machine*) parameters and use them on each acceptable press into which the mold goes. Tempted to say it can't be done?

In a recent case history, the process was initially developed for a 32-cavity hot-runner mold based on plastic parameters only. It ran for six years and then the mold was sent to a different facility in another location. That meant a different press and processor. The setup sheet was requested and emailed to the processor. He set up the process to those plastic parameters documented. His response was "Six years and dead nuts on." So, what is the trick?

There is no trick … you use a scientific method with machines that are calibrated correctly. The setup sheet for the mold provides actual volumes, pressures, temperatures etc. The same plastic parameters are achieved on not just the press but in mold cooling as well. It just goes to show that if you properly document the machine, mold and resin process parameters, good parts are produced, shot to shot, run to run, on one machine or another.

The point is that if we want to make "identical" parts we need to ensure these processing parameters are controlled and measured to be the same within a reasonable tolerance. That mandates that when a processor sets up a process, he or she inputs the process setpoints that provide the same processing conditions (parameters) documented. The numbers input on the machine may be different—for example, hydraulic pressures vary from machine to machine—but the specified actual plastic pressures are the same.

If you visited the estimated 16,000 molding shops in the U.S. you'd wind up with 16,001 different setup sheets.

What process variables do we duplicate? That list is too long for this column, but here are six that *must* be duplicated. I suggest that once a shift, have someone visit each machine running, document each of these process conditions to ensure part reproducibility/accountability between shifts.

1. **Fill time**, within a range of ±0.04 sec, for most jobs. This does *not* mean that the processor inputs the same injection rate in mm/sec or in./sec on the controller. Even if you are using cubic centimeters (volume) the input number may vary as the machine, hydraulic or electric, may not give the same result from one run to another. A machine is composed of mechanical and electrical components, and these do wear (take the non-return valve as just one example). The input for injection rate can vary to provide the documented first-stage fill rate of a given weight, size and fill time.

2. **Plastic pressure at transfer**; it may or may not be peak pressure during injection. It should be the same between runs and machines. This requires use of the same type and size of nozzle tip. The nozzle becomes part of the mold from a pressure-loss point of view.

3. **Cushion**—this does not have to be the same from press to press but must be consistent shot to shot. I target less than about 1 mm variance. I define cushion here as the screw position at the end of second (hold) stage. This is *not* minimum screw position. There are two definitions of cushion, depending on which brand of machine you are using.

4. **Recovery or plasticating time with identical plastic back-pressure.** Not a set rpm, but the same plasticating time, achieved by adjusting the rpm to replicate that time. Replicating circumferential screw flight velocity is more logical, but better results are obtained by replicating plasticating time to replicate melt temperatures.

5. **Cycle time**, replicating pack and cooling time.

6. **Whole-part IR temperature picture**, measured as soon as possible before or after ejection.

Are there other parameters that are important? Absolutely, like melt temperature, but interrupting a production cycle to measure that temperature is a hassle and staying on cycle is important for consistency. There are also cooling parameters and still others, but those will have to wait for another column. The six parameters above are a good start, but remember: They are process results not machine setpoints.

Bottom line: Replicate actual volumes, times, temperatures, and pressures with machines that are capable and calibrated. This may sound complicated, but it is simpler than fighting Murphy on every other run or working with the idea that molding is art rather than science.

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EXTRUSION

A Simple Way to Evaluate Extruder Screws

While there's lots of data that influences screw design, processors usually don't have access to it. So instead, try calculating drag flow to see if your screw is working properly.

By Jim Frankland

The design of extrusion screws can include an almost infinite amount of data when all the polymer properties, performance requirements, and the details of the extrusion system are considered. Most processors do not have much of this information at hand or know how to apply it to determine if the screw is producing the correct output.

As a result, a lot of misconceptions used in the industry prevail, and screws continue to be built in designs that are not optimized. So how do you know if your screws are working properly? One of the most useful evaluations is the relatively simple calculation of drag flow. Drag flow is simply half the volume of one turn of the metering section per second at a specific screw rpm, which, when multiplied by a units conversion and the melt specific gravity of the polymer, is a very accurate approximation of the output in lb/hr at no head pressure.

The most common cause of actual output falling below the theoretical output of the metering section is inadequate feed capacity.

The calculation was developed and verified in the early 1950s, primarily by researchers at Western Electric, as follows:

$$\tfrac{1}{2}\,\pi^2\,D^2HN(\sin\Theta)(\cos\Theta) = \text{in.}^3/\text{sec}$$

You can make a little more accurate by adding a shape factor, which represents the width-to-depth ratio of the screw channel. The shape factor compensates for the edge effects of the flights and the channel shape. For most screws, a shape factor for the metering section of 0.95 works well. So:

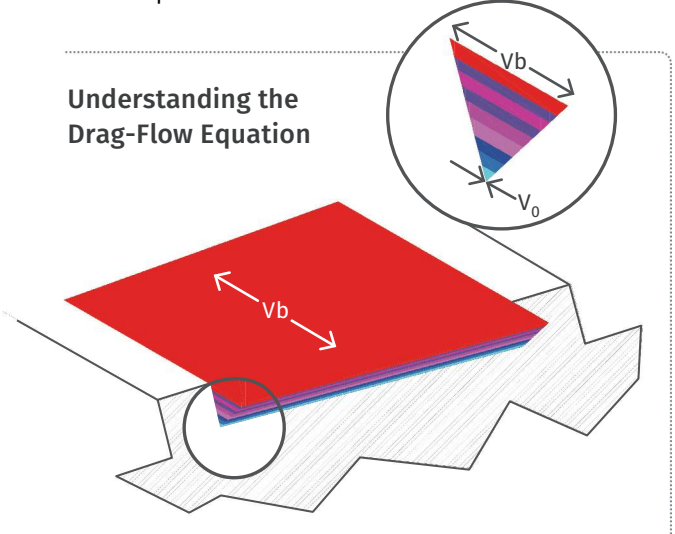
$$0.95\,(0.5)\,\pi^2\,D^2HN(\sin\Theta)(\cos\Theta) = \text{in.}^3/\text{sec}$$

Further, a large percentage of extrusion screws use a standard pitch (flight pitch equals screw diameter) in the metering section, as it represents the best combination of overall performance in most cases. This simplifies the term $(\sin\Theta)(\cos\Theta)$ to 0.289. Additionally, (π^2) can be simplified to 9.87 and N is in revolutions/sec so by adding ‰ the screw rpm can be substituted directly:

$$(0.95)\,(0.5)\,(9.87)\,(0.289)(1/60)\,D^2HN = \text{in.}^3/\text{sec}$$
$$0.02258\,(D^2HN) = \text{in.}^3/\text{sec, where}$$

D = Screw diameter
H = Channel depth
N = Screw rpm

Understanding the Drag-Flow Equation



As shown, the melted polymer sticks equally to the surface of the screw and barrel so that the velocity of the melt in the channel at the screw root is zero (V_0) while the velocity at the outer surface is the peripheral velocity of the screw (Vb). This forms a shear field equal to the Vb at the top and V_0 at the bottom. That yields a triangular shear field moving down the channel or one half the volume of one turn.

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So as a first evaluation of the screw performance in in.^{3}/sec, the only thing you need to know is the channel depth in the metering section. It's assumed you know the screw diameter and the screw rpm. Since the output is in in.^{3}/sec, it needs to be converted to lb/hr for comparison. If you multiply by 130 you get lb/hr.

But since extrusion screws are volumetric devices, the output must be further corrected for the melt specific gravity of the polymer (not the solid specific gravity) by multiplying by that number. Melt specific gravities are available on the internet for all the common polymers. At that point you'll have the estimated output at no head pressure based on the metering-channel depth. At low head pressures (<2000 psi) this is a pretty accurate number in most cases. At higher pressures, or with a very low-viscosity polymer, a second calculation may be needed to correct for the loss in output due to head pressure.

It should be noted that this calculation is for a single-stage screw. For a two-stage (or more) vented screw, the channel depth for the calculation is the first metering section, and it is very accurate estimate because the first metering section has no head pressure if the vent is open.

So what if the output is significantly different than the calculation? There are a host of things that can cause reduced output, but they require more information and more calculations and will be described by further articles. The most common cause of the actual output falling below the theoretical output of the metering section is inadequate feed capacity. Less common is a severe melting limitation whereby the screw becomes plugged with solid polymer.

There are externally measured symptoms that can lead to pretty firm conclusions about these issues without much knowdge of screw design. Another cause is a design where the feeding, melting and metering sections are not balanced, or if there is some restrictive mixer or other device affecting the output. But that requires a screw drawing and a complete analysis by someone with screw-design expertise.

The calculation above approximates what the output should be and indicates whether further investigation is appropriate. Despite all the variables involved in screw design, the drag flow in the metering section is a very good indicator of expected output, because for good screw balance, most designs are based on the metering section. 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 2

Clamp Pressure & Cavity Land Area

What you need to know to prevent flashing and mold damage.

By Jim Fattori

If you are having problems with flash, then blue off the mold. If the blue indicates that there is significantly more contact at the corners of the mold, or the corners of the cavity inserts, and not much around the perimeter of the cavity, then you have a problem. But is the problem due to the mold, the machine, or the mold in the machine?

Since mold bases are typically two to three times harder than the soft cast-iron platens of a molding machine, the platens will wear over time. It stands to reason that the older the machine, the greater the amount of wear. And that wear will be predominantly in the center, resulting in a platen that is somewhat concave. This condition won't be very evident on small molds in large machines, but it can cause flash to form on the inner edges of a part and runner on larger molds, due to a lack of support in the center.

You can overcome this problem by adding shim around a flanged locating ring, or by pre-loading the center support pillars. But on the next run, when the mold is hung in the original smaller machine, you may develop flash on the outer edges of the part and accelerate wear in the center of the platen. To solve the root cause of the problem and prevent this condition with all your molds, the worn platen should be removed and machined flat.

Core inserts should protrude slightly beyond the surface of the plate in which they are mounted.

If you are a custom injection molder, you're probably flipping molds several times a day. To satisfy customer delivery requirements, smaller molds are often put in larger presses due to machine availability at that time. If the width and length of these molds are less than roughly 70% of the distance between the tiebars, they can be subjected to a condition known as "platen wrap." When the machine is clamped under high pressure, the platens literally wrap around the mold and cause the corners of the mold to hit harder than it does in the center. If you have any dents in your platens that look like the corners of a mold dug in, they probably did. This can result in the part flashing on the inner edges as well as the runner, which are the same results you might see with a large mold mounted on a concave platen.

The rust marks on just the corners of this insulator plate suggest the molding machine's stationary platen is concave from wear.

It's possible that the stack-up tolerance of all the mold plates causes one corner, or one side of a mold to be thicker than the others. This would cause the platen to squeeze the mold unevenly and can also cause a mold to flash. But unless some grievous error was made during mold construction, this is not a very common occurrence. The more likely cause, other than a concave platen or platen wrap, is the mold design itself.

If the cavities are machined directly into the cavity plate instead of into individual inserts mounted in pockets, or mounted on the face of the cavity plate, this is called "cut in a solid." The same machining configuration can also be employed on the core side, but this is usually only done on prototype, bridge, pre-production, or other low-volume molds, to save time and money. Since there are exceptions to almost every rule, depending on the geometry of the part, you will occasionally come across a high-volume mold with both sides cut in a solid. ►

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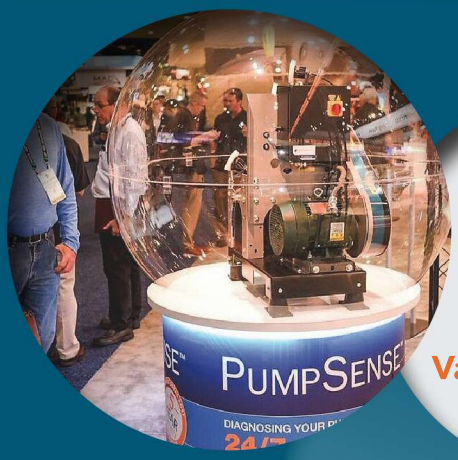

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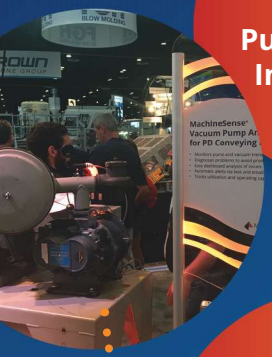

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Core inserts should protrude slightly beyond the surface of the plate they are mounted in. The same is true for stripper-ring inserts in a stripper-plate mold. This is called being "proud." Some moldmakers like the inserts to protrude about 0.002 in. to 0.005 in. Others like to go as much as 0.020 in. to 0.030 in. There are pros and cons to both preferences. I prefer just a few thousandths proud. The important thing is that the inserts are above the surface of the plate. If they don't protrude at all, the parting-line shutoff area becomes the entire surface of the plate, minus the area of the cavity and runner, and that can cause a problem.

If neither core nor cavity are proud, I suggest relieving a triangular area, with a base leg of 2 to 4 in., at each corner of the parting line by just 0.002 to 0.004 in. This guarantees the corners of the mold will not hit first if a platen-wrap condition exists. This small amount of relief also helps prevent potential damage to critical shutoff areas caused by anything that can make the mold rock, such as accidently closing on a molded part. Conversely, if the core or cavity are proud by more than 0.005 in., adding safety pads in the corners of the mold with the same 0.002 to 0.004 in. of clearance can be a smart precautionary measure. This is particularly important for single-cavity or offset molds where the cavity may be machined in the lower half of the mold, and nothing is machined in the upper half.

Now let's talk about pressure. If a 200-lb man steps on your foot with the front half of his shoe, it's going to hurt. If a 100-lb woman, half the weight of the man, steps on your foot with the small end of her high heeled shoe, you're going to have a broken toe. It all comes down to pressure. Pressure is equal to the force divided by the area. When it comes to injection molding, the force is equal to the tonnage of the molding machine. That's a fixed value.

If your parts are flashing, you probably think it's because the machine is too small and doesn't have enough clamp force. But before you go hanging the mold in a larger press, blue off the mold and look at where that force is being applied and how much total area is involved.

There is a bit of a balancing act regarding where a mold should shut off and by how much. You typically don't want to shut off over the entire face of the mold. This will only make the problems associated with platen wrap or platen concavity that much worse. Nor do you want the force localized or concentrated on a specific area where it may exceed the fatigue strength of the steel. (Note: Yield-strength values of steel are based a non-cyclic or single constant load. Fatigue strength, or endurance limit, is where the number of cycles to failure is infinite. Fatigue strength is roughly 10% to 20% of a material's yield strength.)

All molds must have what's called a "land" or shutoff area around the sprue bushing, runner and perimeter of the cavity. If they don't, the material will squirt out and create flash. For good reason, the land area around the cavity is often referred to as the "cavity seal." The width of this land must be enough to prevent excessive compressive loading and prevent the fragile vents from collapsing. The total land area of the mold is equal to the total area of the cavity seal, plus all the other areas or faces that contact with one another when the mold is closed.

There is a bit of a balancing act regarding where a mold should shut off and by how much.

Except for conical and bar-type interlocks, which need to be slightly preloaded in order to be effective, it is extremely important that all of the other contact or shutoff areas hit almost exactly at the same time. A low-pressure alignment study is perfect for verifying whether they do or not. (See Part 1 of this column in last month's issue.) If they don't shut off at the same time, the areas that hit first will be subjected to the highest compressive force, and potentially exceed their fatigue strength.

Since the plastic pressure inside a mold continually decreases as the melt travels along the flow path from the machine nozzle tip all the way to the end of fill, the highest pressures are in the sprue, runner and gates—and those are where you need a significant amount of land. It is for this reason that I don't recommend adding any vents near a gate. They reduce the land area in this critical location and are usually ineffective there, anyway.

Platen wrap can cause the corners of a mold to create indentations.

Since the fatigue strength of steel is appreciably less when the surface is rough or has a notch-sensitive stress riser, a good rule of thumb is not to have any more than 3.5 tons/in.^{2} of pressure on materials having a hardness value of 300 Brinell (32 Rockwell C), or any more than 5 tons/in.^{2} on materials having a hardness value of 50 Rockwell C. Any more pressure than that can cause the material to exceed its fatigue strength and collapse over time.

Let's run some numbers as an example. We know pressure (lb/in.²) = force (lb)/area (in.²). So if a 100-ton (or 200,000-lb) machine clamps on an 8.5 × 8.5 in. core insert mounted proud in the B-plate, and the opposing A-Plate cavity depression is 7 × 7 in., the pressure on the resulting ¾-in.-wide land area around the cavity is equal to:

200,000/((8.5 × 8.5) – (7 × 7)) = 8602 psi or 4.3 tons/in.².

That is perfectly acceptable for a heat-treated cavity and core, but not acceptable if either one of the two mating components is pre-hard. In a case like this, you need to add some load-carrying or load-bearing pads to increase the total land area and absorb some of the force, because in this example, the total land area is insufficient and the vents are subject to collapsing over time.

Now for the bad news: Bluing off a mold only solves half the mystery. It tells you where the steel is hitting when the mold is clamped, but not whether the support within the mold is sufficient to resist the injection pressure of the molten plastic. If you put a magnetic dial indicator on the parting line, you can easily determine whether the mold is opening due to insufficient clamp force and how much injection pressure it takes to do so. But if the indicator doesn't budge, or if the flash is thicker than the indicator reading, the mold may be collapsing internally.

A high-volume hot-runner mold with both sides cut directly into pre-hardened plates..

There are a number of potential causes for this: insufficient number of support pillars; support pillars that are too small in diameter and are sinking into (coining) their adjoining plates; one or more of the plates is too thin and is flexing; or insufficient steel supporting the back of the cavity or core inserts. For hot-runner molds, there may not be enough manifold support. Any one of these conditions can cause a part to flash regardless of the tonnage of the molding machine.

It's common to get a small amount of flash opposite a sprue bushing subjected to very high injection pressure, especially at very high injection velocities. Preloading the center support pillar 0.001 to 0.003 in. will usually solve this insufficient support problem. If you have to use 0.003 in. or more of preload in the center of the mold, use progressively smaller amounts on the adjoining pillars until you get to the rails. This is referred to as crowning the mold, like the arch on many flatbed tractor trailers. But you should really look for the root cause of why you need so much shim. Increasing the thickness of the B-Retainer plate might be a better option. As a side note, I don't recommend ever using AISI 1030, DIN 1.1178, or # 1 medium carbon steel for mold bases. Some brands aren't even on the Rockwell C hardness scale and can be the root cause of some of the problems I just mentioned.

Bluing off a mold only solves half the mystery.

I am not a big fan of doing things twice. When sampling a mold, I like to use a machine I know will have sufficient clamp force. Once the process is established, the tonnage is reduced until there is a dimensional or aesthetic issue, such as flash. From there, I add a safety factor—usually 20%, to give me the ideal machine size for that particular mold.

A word of caution: If a mold tpically runs in a certain size machine, but only a larger machine is available the next time it is scheduled to run, make sure the clamp tonnage is set to the lower tonnage of the smaller machine. If you get burns, shorts or high gloss on the outer edges of the parts, you may have just crushed the vents. If you get sticking in the cavity and can feel a small lip or burr of steel on the inside perimeter with your finger nail or a sharp pencil—you just rolled over the edge of the cavity seal. What will really make you pull your hair out is when the texture on the sides of the part begins to abrade and scuff, or the parts begin to stick in the cavity, but you don't see or feel anything in the mold. Excessive tonnage can cause the side walls of a cavity to collapse, thereby reducing the draft angle. Neglecting to use the proper tonnage can cause extensive—if not catastrophic—damage to both the mold and the machine. If you don't have a system or procedure in place to ensure the proper tonnage is used, you should consider adding a large placard on the outside of the mold.

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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By Jim Callari
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The One Company Solution

Primex has vertically integrated its color compounding, sheet extrusion, and fabrication businesses to provide a single-source solution to customers in a wide range of industries.

In front of a new extrusion line to produce proprietary Bubble-X sheet are (back, l-r) Primex's Tim Schultz, v.p. sales and marketing; Michael Cramer, president; (front l-r); Doug Borgsdorf, business-unit director; and Jeff Longsworth, general manager, Richmond.

Primex Plastics: The name evokes a long history of innovation and tradition in sheet extrusion. That's understandable. The company was founded in 1965 with the goal of becoming the leader in the custom sheet extrusion industry. It started in Englewood, N.J., with three extruders. Today, it runs 125 extrusion lines in six plants in the U.S. and Great Britain. Extruders ranging in size from 4.5 to 8 in. produce sheet at widths from 54 to 180 in. and in thicknesses from 0.006 to 0.5 in. Companywide, it carries a raw-material inventory of 70 million lb. Headquartered in Richmond, Ind., the company produces about 500 million lb of sheet per year, employs 1250 people, and has annual sales of about $500 million. Primex is part of ICC Industries, a New York-based holding company that owns various firms in plastics, chemicals and pharmaceuticals.

Primex Design & Fabrication welds its Bubble-X sheet to form corners (inset) and mates it with a thermoformed component to create a shipping container.

These are big numbers; and make no mistake, Primex Plastics Corp. (*primexplastics.com*) is a big company. In manufacturing and other industries, the perception many have is that bigger companies tend to be slow moving and inflexible, whereas smaller firms are more inclined to be nimble and customer concentric. But under the leadership of long-time president Michael J. Cramer, Primex has maintained its entrepreneurial spirit despite its robust size. "Our decision-making process is guided by what's good long-term, not necessarily what's best for the next quarter," Cramer says.

Tim Schultz, Primex's v.p. of sales and marketing, puts it this way: "I consider us a large national manufacturer that operates as a regional company. We're quicker to react than most companies our size to the different needs of the customers we serve. We are large enough to handle any customer's requirements, yet small enough to handle their needs. That happens to be our company's motto, but it's more than just words. It really guides what we try to do every day."

"We'll continue to invest to bring more innovative materials, capabilities, and high-quality products to the market."

Primex Plastics is about more than just sheet. It has recently undergone a rebranding effort to more clearly establish itself as a vertically integrated, "one company" business that links sheet extrusion with color-concentrate manufacturing on one end and fabrication on the other, says Schultz. In 1988, ICC bought the O'Neil Color plant in Garfield, N.J. Five years later, it bought a second color-concentrate plant in Jasper, Tenn. It has since renamed that operation Primex Color, Compounding & Additives (*primexcolor.com*). In 1987, ICC purchased plastics fabricator Woodruff Corp., now known as Primex Design & Fabrication.

"We're customer-centric across all divisions," says Cramer. "We'll continue to make investments that allow us to bring more innovative materials, capabilities, and high-quality products to the market as we pursue the perfect solution to meet customer needs."

The firm's businesses in sheet, color and fabrication are supported by The John J. Farber Technology and Innovation Center, located in Richmond and named after the chairman of ICC. This world-class, A2LA accredited and ISO 9001 certified lab and innovation and development hub features state-of-the-art analytical equipment such as DSC, FTIR, TGA, QUV/xenon-arc weatherometer, and an array of testing platforms for physical properties and color analysis. At the center, Primex works with customers and prospects to identify and develop materials for their exacting applications.

The development facility is also furnished with processing equipment to produce tapes, color chips, molded test bars, sheet, and thermoformed parts so that Primex can analyze and quantify processing characteristics, perform complete physical testing, analyze color accuracy, and allow customers to see their materials in a finished state.

EYE FOR COLOR

Primex Color, Compounding & Additives (*primexcolor.com*) supports Primex's sheet extrusion business—the sheet operation was a major customer of O'Neil Color—along with a variety of other customers. The Garfield operation has eight lines—seven twin-screw lines ranging from 27 to 64 mm, along with a 5-in. single-screw line—and focuses on highly customized orders in lots from 30,000 to 40,000 lb, says Robert Hillyer, general manager. The facility in Jasper, on the other hand, handles more generic compounds and utilizes larger production lines that focus on polyester color and performance additive packages.

Specialty compounds include the Faralloy product line providing flame suppression, UV stability, impact resistance, flexibility, and other performance enhancements to PP, PE and PS

The Primex Color, Compounding & Additives plant in New Jersey houses eight extrusion lines and focuses on high-value, short runs in a variety of materials for a wide range of applications.

products. FaraColor color concentrates and polymer colorants provide special effects such as pearlescent, phosphorescent, granite/marble and metallics. Stock white and dry dispersions are also produced. Products are supplied to markets such as automo-►

tive, packaging, building/construction, medical, and sporting goods. "We're not married to a particular industry," says Hillyer. "We have our eggs in a lot of different baskets."

"We are a company that's extremely diverse in terms of the markets we serve. It's a key part of our business strategy not to be overwhelmingly tied to one market or another.

Production lines at the Garfield operation are gravity fed by mixers housed on a mezzanine. With more than 6000 different formulations on hand, the Garfield plant has condition sheets for every product it runs, giving operators easy access to preset processing recipes. Four small injection presses are used to produce color chips for color matching and quality control. The facility also has a two-roll mill, two lab-scale sheet lines, and a lab-scale roto-molding machine, as Garfield supplies dry color for this process. The lab is also equipped with the full range of testing equipment, including spectrophotometers, melt indexers, moisture analyzers, light boxes, and more. Hillyer reports that Garfield's business was up 29% in 2017 from the year before, and that the first quarter of 2018 is also tracking well.

SHEET FOR A VARIETY OF APPLICATIONS

Primex runs sheet in a wide range of materials, with each plant having coextrusion capacity. Most of the sheet Primex extrudes is sold through distributors and directly to thermoformers as either rollstock or cut sheet. It also has established a return program with customers that results in recycling more than 150 million lb/yr of post-industrial scrap, mostly thermoforming skeletal trim.

Primex works with customers to select the right material and blend so that the sheet is fine-tuned to the application and it has the proper "sag" during the thermoforming operation, assuring even

Labs at Primex Color, Compounding & Additives are furnished with testing equipment such as this Atlas Horizontal Vertical Flame Chamber for UL94 flammability testing of plastic materials used in consumer electric devices and appliances.

material distribution and wall thickness. Applications for Primex's PE products are far flung. One of its HDPE product lines, for example, is aimed at trays, food packaging, small dunnage, or any other parts that require low-temperature impact. It also works well for small lawn-tractor parts and many other small tool components. Primex offers a line of LDPE sheet for packaging applications such as pharmaceuticals, dried fruits, and meats. It is also being used for dunnage in the computer industry, as well as for drum liners. An HMW-HDPE sheet line targets feeders, pallets, truck-bed liners, portable toilets, and totes, among others.

Primex recently introduced a new swirl-patterned HMW-HDPE product that can be color coordinated to meet customers' requirements. Thickness of the sheet ranges from 0.100 to 0.350 in., and widths are up to 90 in. The swirl pattern can be designed to fit a variety of uses that are product-specific for each customer's needs. The three-layer structure consists of an HMW-HDPE substrate with a three-color swirl cap of HMW-HDPE that can be on one or both sides of the sheet. Applications so far have consisted of playground equipment, camouflage deer blinds, canoes, and other sporting equipment.

Primex provides rollstock or cut sheet.

Primex also runs a wide range of ABS sheet for tub/shower surrounds, pickup truck caps, boat accessories, automotive trim parts and computer housings. Primex runs copolymer PP sheet for food and medical packaging, as well as orthopedic and prosthetic applications. Talc- or calcium carbonate-filled grades are used in microwavable food packaging. The company runs PETG for food trays, cosmetic packaging, thermoformed clamshells and blister packaging.

Primex is also reportedly North America's largest producer of custom PS sheet. It is produced in up to five layers for applications that include thermoforming, fabricating, printing (silk-screen, flexographic, lithographic and register grade), high gloss, chemical resistance, moisture barrier, marbleized, pearlescent, and two-color sheet. For food and medical-device packaging, Primex supplies PS sheet extruded from 100% virgin resins. ►

All sheet produced by Primex is subjected to vigorous on-line and offline quality-control checks for thickness variations and other defects.

The company also offers biobased sheet products. An agricultural-based material is used to produce Biograph.ics sheet that is said to offer higher heat resistance and greater impact strength than sheet processed from other biobased materials. What's more, this sheet has demonstrated superior ink receptivity over petroleum-based products for graphics.

Primex's Absolve product line is a compostable sheet for applications that currently use PS, PP, and PE. Absolve incorporates special polymer technology to facilitate degradation of litter and commercial or household compost, as well as in landfill disposal. It is available in sheet or roll for printing or forming.

Says Schultz, "We are a company that's extremely diverse in terms of the markets we service. It's a key part of our business strategy not to be overwhelmingly tied to one market or another."

Throughout its operation—including its largest sheet facility in Richmond, which is equipped with 40 lines—extrusion lines are organized by polymer family. All are equipped with gravimetric blending and on- and offline gauge control. Primex buys flat dies from established suppliers and fine-tunes them to the specific application. States Schultz, "We have enough capacity to fill even specialty orders quickly. We run lines around the clock. Our turnarounds are tight. Our order minimums

"We are large enough to handle any customer's requirements, yet small enough to handle their needs."

are 1000 lb for wide sheet made from specialty materials, and our lead times there are two to three weeks."

Primex Plastics' most unusual PP sheet is called Bubble-X, a three-layer, lightweight, rigid coextruded board made by a proprietary process. It has a thermoformed honeycomb core and two solid, skin layers with smooth, matte, or embossed finishes. These skin layers are corona-treated to improve printing performance. Primex can laminate decorative or specialty films to the board. Bubble-X is used to fabricate sleeve packs, which when combined with a matching pallet and cover, are lightweight alternatives to corrugated paperboard and molded containers, including internal dunnage.

Primex Design & Fabrication produces a range of protective packaging solutions that start with Primex sheet, including products for handling automotive lenses.

FABRICATION SPECIALISTS

Primex Design & Fabrication (***primexfabrication.com***) takes its sister companies' corrugated and solid sheets and turns them into packaging solutions. Housed a short drive from the Richmond sheet extrusion plant, this business unit makes products like corrugated returnable bins, totes, trays and point-of sale signage; protective packaging; customized work-in-progress packaging; and corrugated signs. It's heavily focused on protective packaging with an emphasis on Tier 1 and 2 automotive suppliers, and recently hired a product manager for this area.

Primex Design & Fabrication has multiple die cutters, routers and presses that can handle virtually any size sheet application in virtually any material thickness. There are also sonic welders and heat sealers; printers for spot colors and four-color processes; automated wire-forming machines for tote and dunnage reinforcement; foam cutters; and laminating, gluing, sewing, and kitting operations.

States Doug Borgsdorf, business-unit director for Primex Design & Fabrication and Primex Color, Compounding & Additives, "By vertically integrating, we have created a 'one company' philosophy to bring customers the best quality and pricing available in the industry. We are part of the entire supply chain, so customers never have to worry about delivery, consistency or material that meets their exacting specifications." PT

Novel Polyolefin Additives for Automotive Offer Unprecedented Improvements

Three new game-changing additives boast dramatic improvements in UV and thermal stabilization and mechanical properties of PP for auto interior and exterior components—and more.

Compared with two workhorse UV stabilizers, Solvay's Cyxtra V9900 has been shown to impart superior gloss retention and color stability that meet the toughest high-temperature interior weathering requirements.

By Lilli Manolis Sherman
Senior Editor

Every few years in the world of additives for polyolefins, a few notable products are launched that either challenge or complement well-established industry workhorses. Three such new additives, one from Solvay Technology Solutions, Saddle Brook, N.J. (***solvay.com***), and two from Milliken & Company, Spartanburg, S.C. (***milliken.com***), are aimed primarily at PP interior, exterior and underhood automotive components but also show significant potential for non-automotive applications.

UV STABILIZER FOR TPO & CFRP

Solvay Technology Solutions is a new business unit that was formed following Solvay's acquisition of Cytec's Cyasorb Cynergy Solutions, which develops and produces hindered amine light stabilizers (HALS) and various UV absorbers. The Polymer Additives div. of Solvay Technology Solutions has now developed what is said to be a next-generation UV stabilizer—a combination of a monomeric high-molecular-weight (HMW) HALS and a non-traditional UV absorber that reportedly meets all worldwide automotive UV weathering specifications.

New Cyasorb Cyxtra V9900, compared with two other workhorse UV stabilizers, has been shown to confer superior gloss retention and outstanding color stability that meet the toughest high-temperature interior weathering requirements. Moreover, it is said to surpass automotive requirements such as low VOC emission, low fogging, and low odor, and does not interfere with paint adhesion. Says Andrea Landuzzi, global marketing director for additive technologies, "The automotive industry is quickly turning to thermoplastic polyolefins (TPOs) and carbon-fiber reinforced plastics (CFRP) to help them develop lighter, more fuel-efficient automobiles with lower emissions. The U.S. Corporate Average Fuel Economy (CAFÉ) standard increases the mileage of new car models from 39 miles to over 50 mpg by 2025, while in Europe OEMs must reduce CO_2 emissions for new cars to 95g/km on average from 2020."

Next-generation Cyxtra V9900 UV stabilizer reportedly meets all worldwide automotive UV weathering specifications.

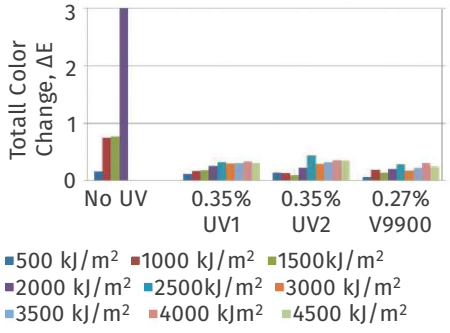
Cyxtra V9900 has been shown to protect the physical properties and aesthetics of automotive TPOs against UV exposure, extreme temperatures and other environmental factors. The company claims this advanced stabilizer delivers an optimal balance of processing and cost efficiencies with a high degree of performance durability. It can enhance TPO performance in a broad range of automotive applications, including bumpers, door panels, seatback covers, pillar moldings, door trims, instrument panels, head and side impact areas, fender liners and flares, taillight housings, and cowl vents.

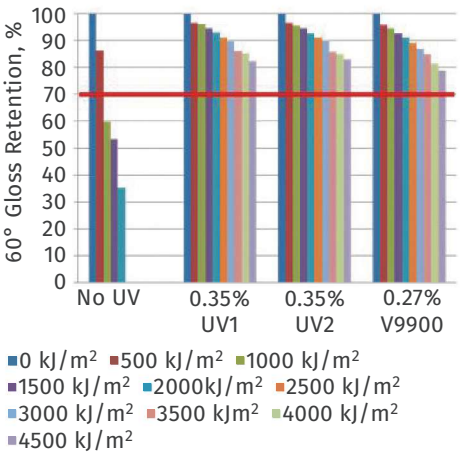
It has also been shown to protect surfaces of CFRP in aerospace and automotive components used in the BMW i3, as well as surfaces of 40% long-glass PP exterior parts.

In addition to polyolefin automotive stabilization, Cyxtra V9900 shows significant potential for use in multilayer agricultural films requiring increased weatherability and pesticide resistance. By the end of the year, the company will have results of agricultural film trials.

Meeting Automotive Exterior UV Specification (SAE J2527) While Providing Lower Cost-to-Stabilize Ratio

Talc-Filled Black-Pigmented TPO





MODIFIERS FOR PP IMPACT COPOLYMER

Milliken has a developed what is characterized as an unusual family of modifiers that represent a radical advancement in additive technology for PP impact copolymers (ICPs) as well as recycled PP.

The patent-pending DeltaMax family, described as novel reactive extrusion modifiers, reportedly maximize PP impact strength and MFR without compromising stiffness. These improved properties allow PP to be used in a wider range of applications in more cost-effective ways. This is a new additives platform addition to Milliken's line of clarifiers and nucleating agents. According to Prem Patel, global business-development manager for plastics additives, Milliken is already working on a new generation of DeltaMax additives with a focus on functionality and value.

In bumpers and exterior panels, which typically require average loadings of 10-20% impact modifier, adding Milliken's DeltaMax at 0.5-1% can reduce those loadings by half.

DeltaMax technology reportedly is also highly effective in modifying post-consumer and post-industrial recycled resins. It elevates impact and melt flow to the same level as—or better than—those of virgin resin, a capability that allows compounders and converters to incorporate up to 100% recycled PP without sacrificing performance or processing. The DeltaMax line currently comprises three grades: ►

- a200 All-Purpose Modifier, said to provide a strong balance of impact, stiffness and MFR to maximize the physical properties and processability of ICPs.

- i300 Impact Enhancer, said to maximize impact strength while optimizing MFR for improved physical properties and processability of ICPs.

- m100 Melt Flow Modifier, said to increase MFR while providing equal or better impact performance to maximize physical properties and processability of ICPs.

Says Patel, "DeltaMax modifiers address a long-standing unmet need in the PP industry for higher impact at higher MFR. "DeltaMax simultaneously improves both impact and melt flow in PP impact copolymers and recycled resins, which now enables converters to make parts stronger, lighter and faster than before. It also improves the sustainability profile of the industry and provides a range of other processing, energy-reduction and system-cost benefits. The net effect is that converters, brand owners and OEMs can now meet market needs for higher impact driven by e-commerce shipments and increasing automotive safety standards, while keeping a keen eye on improving sustainability and costs."

Milliken's HPN-715 nucleating technology provides higher HDT, allowing PP to be used in underhood components like battery cases.

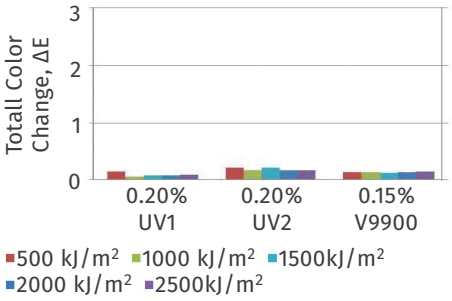
Primarily targeted to processors using neat or recycled PP, the three DeltaMax modifiers are generally recommended for use together, with typical masterbatch letdown ratios of 0.5-1%. "Our goals was to improve PP overall, so we are actually competing with specialty, higher-performance, higher-MFR, high-impact PP resins or competing with PP compounds that are impact modified," explains Patel. In the latter case, 5-20% letdown ratio of impact modifier is typically used, which increases impact but decreases stiffness and reduces MFR. In fact, for some soft TPOs, loadings of as much as 40% impact modifier are required, according to Patel.

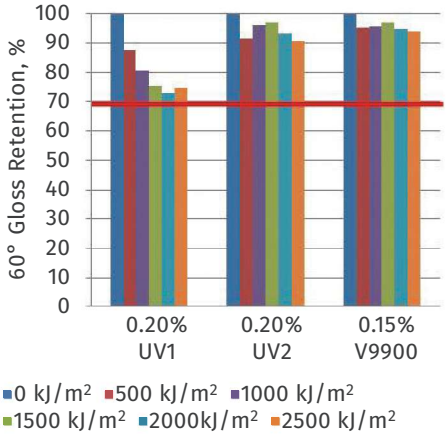
DeltaMax modifiers reportedly offer processors the ability to increase impact performance, maximize melt flow, or achieve a precise balance of the two. The flow modifier can raise melt flow by as much as five times while maintaining impact and stiffness. This improvement allows processors to increase operating efficiencies and create more innovative part design with easier flow through molds. The impact modifier increases impact strength by as much as three times by optimizing rubber dispersion and domain size. This higher impact performance allows compounders to decrease rubber content to reduce weight and costs.

Automotive applications include bumpers and exterior panels, instrument panels, door panels and other interior components where low flow length is ideal, and underhood components such as battery housings. As part of its product-development process, the company has tested DeltaMax with pilot customers. In bumpers and exterior panels, which typically require average loadings of 10-20% impact modifier, addition of DeltaMax at 0.5-1% can reduce those loadings by half, says Patel. As for battery cases, injection molders want to work with a PP impact copolymer that has over 20 MFR vs. a typical 6-10 MFR.

Meeting Automotive Interior UV Specification (SAE J2412) While Providing Lower Cost-to-Stabilize Ratio

Talc-Filled Black-Pigmented TPO





Patent-pending Delta Max additives are novel reactive-extrusion modifiers that maximize PP impact strength and MFR without compromising stiffness.

Non-automotive target applications for DeltaMax include PP copolymers and compounds for housewares such as totes and hampers; lawn-and-garden products such as outdoor furniture and flowerpots; and industrial crates, battery cases and pails. These PP materials can also be used in appliance components such as washer drums, refrigerator trays and motor housings.

PP NUCLEATOR BALANCES STIFFNESS, IMPACT

HPN-715, the latest addition to Milliken's family of Hyperform nucleating agents, is engineered for injection molded PP and boasts stiffness increases of up to 10% versus competitive ►

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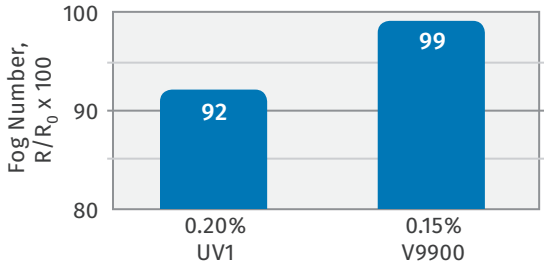
Minimal Fogging Potential

SAE J1756 — Determination of the Fogging Characteristics of Interior Automotive Materials (Photometric Method)

Instrument: Hart Scientific 0011 Fog Chamber
Temperature: 100 C
Cooling Plate: 21 C
Exposure Period: 3 hours
Post Conditioning: 1 hour



Fog Number is defined as

$$\frac{\text{60° reflectance value of a glass with fogging deposits}}{\text{60° reflectance value of a glass plate without fogging deposits}} \times 100$$

OBSERVATION: The glass plates were examined and there were no large liquid oily droplets and no crystaline deposits or an oily film.

materials while maintaining desirable impact performance. Optimized stiffness/impact balance enables thinner-wall designs and reduces the need for fillers, promoting lightweighting, design flexibility and cost reduction. Moreover, this new nucleating technology reportedly provides higher HDTs than with other advanced nucleators, allowing PP to be used in vehicle under-hood components, where it can potentially replace engineering resins like styrenics or nylons; and in opaque microwaveable containers and washing-machine and dishwasher components.

According to Bhavesh Gandhi, global product-line manager, this powdered agent is targeted to compounders and resin suppliers at typical use levels of 1000 ppm. Ghandi says this agent is a novel organic salt designed for maximum improvement in physical and thermal properties of PP. He also confirms that Milliken has filed patents on the technology and that the product has been tested for both automotive and appliance applications. "HPN-715 provides opportunities to upgrade PP to compete against engineering plastics, including styrenics. In terms of nucleation technologies, HPN-715 provides superior performance over conventional as well as advanced nucleating agents."

Hyperform HPN-715 nucleating technology has raised the bar for stiffness and thermal stability of PP, says Ghandi, noting that it was developed in response to industry demands for PP with maximum stiffness to address new environmental, cost and performance challenges.

HPN-715 surpasses competitive additives in several ways. First, it delivers the highest stiffness available for PP ICPs, homopolymers and high-crystalline materials. This is up to 10% higher than PP with other nucleators, and up to 30% higher than non-nucleated PP. Second, due to its effectiveness at very low loadings, the new product avoids negative effects on impact performance. Traditional nucleating agents require users to sacrifice impact to gain greater stiffness.

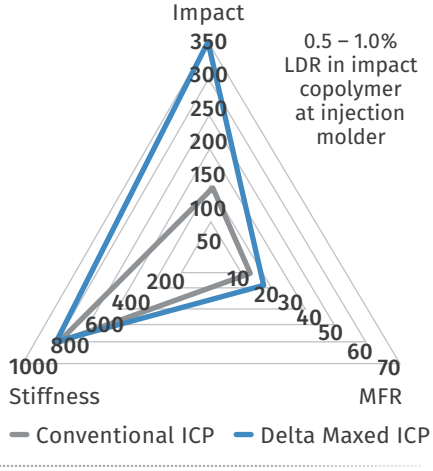
HPN-715 nucleating agent boasts up to 10% increased stiffness versus competitive materials while maintaining desirable impact properties.

The HPN-715 technology is also said to excel in thermal stability by improving the HDT of PP. Compared with other nucleators, HPN-715 enables PP to achieve HDTs that are 5-7° C (9-12.6° F) higher. Compared with non-nucleated PP, the HDT improvements are even more dramatic: 25-30° C (45-54° F) higher. With this increase in HDT, parts made with HPN-715 nucleated resins can withstand strenuous thermal conditions, especially in automotive and appliance parts and microwavable food packaging.

In automotive underhood parts, the higher stiffness delivered by this nucleating agent can reduce loadings of glass fiber and talc to lower weight and improve flow and surface finish. Application examples include automotive air-filter casings, battery cases and containers for windshield washer fluid.

Moreover, the higher HDT allows opaque PP containers made with HPN-715 agent to better withstand microwaving. Small appliances that generate high temperatures, such as coffee makers and electric kettles, can use high-crystalline PP enhanced with HPN-715 instead of more expensive engineering thermoplastics to achieve higher wattages or incorporate thinner-wall parts. PT

Delta Max i300 Impact Enhancer



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The Automotive Division of the Society of Plastics Engineers (SPE®) is announcing a "Call for Nominations" for its 48th-annual ***Automotive Innovation Awards Gala,*** the oldest and largest recognition event in the automotive and plastics industries. This year's Awards Gala will be held Wednesday, **November 7, 2018** at the Burton Manor in Livonia, Mich. Winning part nominations ***(due by September, 15, 2018)*** in 10 different categories, and the teams that developed them, will be honored with a **Most Innovative Use of Plastics** award. A **Grand Award** will be presented to the winning team from all category award winners.

SPONSORSHIP OPPORTUNITIES

This annual event currently draws over 800 OEM engineers, automotive and plastics industry executives, and media. A variety of sponsorship packages - including tables at the banquet, networking receptions, advertising in the program book, signage at the event and more are available. Contact Teri Chouinard of Intuit Group at **teri@intuitgroup.com**.

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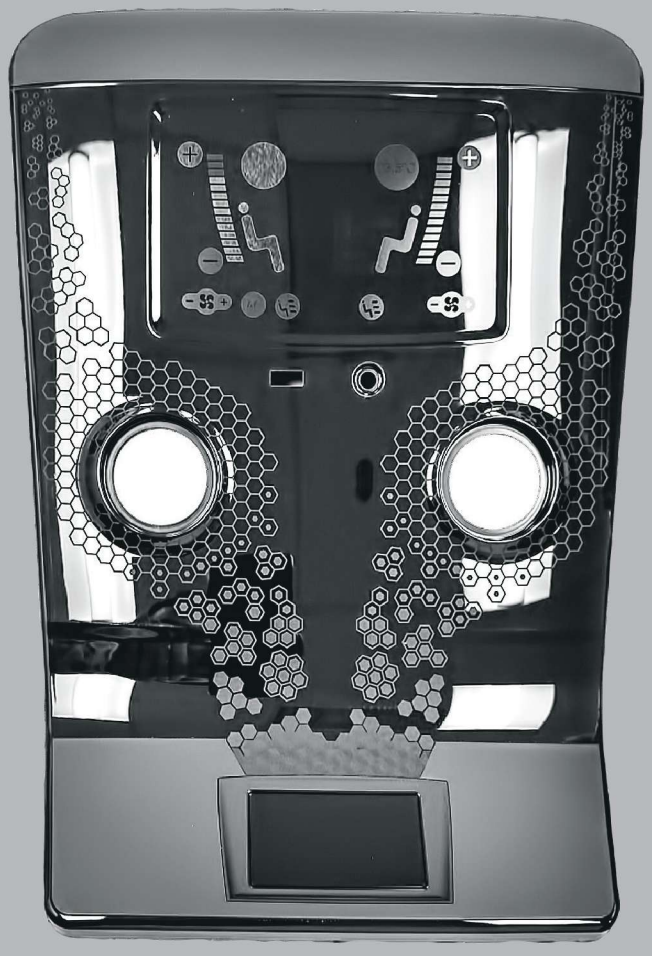


Rapid Heat & Cool Molding Evolves to Meet Industry Challenges

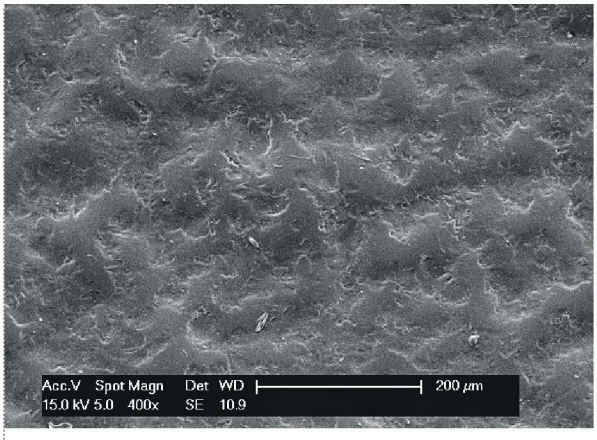
Technical capabilities of the process have advanced to erase former cycle-time penalties, and ongoing developments address creation of a materials database and new applications in hybrid composite injection overmolding.

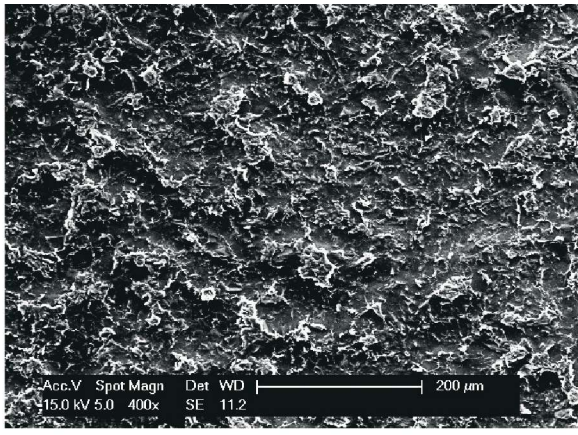
By Mathieu Boulanger
Roctool

Rapid heat-and-cool molding technologies have attracted increasing interest and use in plastics and composites molding. However, there are still challenges to address before rapid heat-and-cool (H&C) technologies will become widely established as a new molding standard. One of the key challenges is educating the industry on what H&C molding can do and how to quantify the advantages it offers with specific resin families. A year ago, Roctool sought to address these needs with a new approach whereby we proposed to work with resin providers to quantify the advantages of our H&C technology with their materials versus conventional molding methods. This growing materials database can be used by molders to determine their tool-design choices and by OEMs in their part-design decisions. The results are also shared with Roctool users to support them in their continuing search for improved performance, quality and cost-effectiveness.

Roctool's induction based High Definition Plastics (HD Plastics) technology can produce high-gloss surfaces, even with filled compounds, and exact replication of the finest mold detail, avoiding the need for secondary decoration.

Many already know that H&C molding can improve surface quality, such as hiding visible weld lines and flow lines. However, our ongoing investigation with resin providers is demonstrating many other advantages that can greatly help molders around the globe: increasing flow length, reducing or eliminating sink marks, reducing pressure drop, enabling thin-wall molding, and enhancing surface replication for optical and functional applications. The latter benefit, in particular, is one reason Roctool has adopted the trade name "HD Plastics" (HD for High-Definition) to describe our overall H&C technology program.





Part surfaces at 400X magnification shows that induction-based H&C technology produces much finer replication of mold surface texture (right) than with conventional injection molding (left).

With the latest technology, processing and aesthetic benefits of H&C molding can be achieved at no cycle-time penalty.

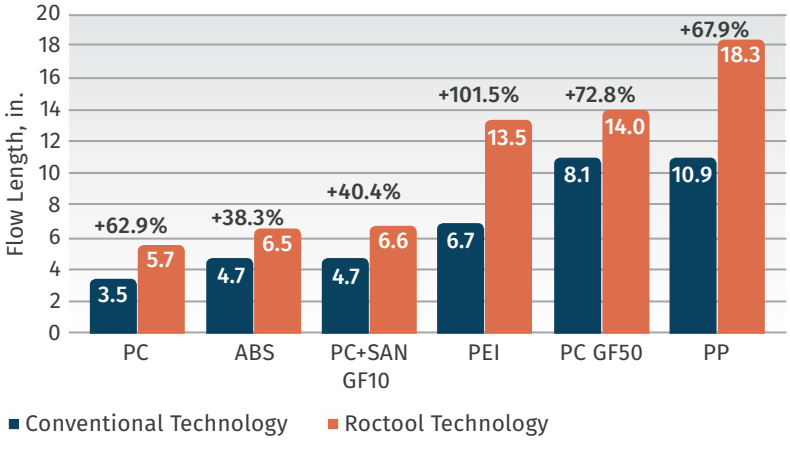
Another challenge for H&C molding is cycle time. Many years ago, when Roctool started using its induction heating technique for rapid H&C injection molding, there was an unacceptable cycle-time penalty. Today, we are able to match a conventional molding cycle or even reduce it, depending on the resin used. At NPE2018 last month, we demonstrated a 16-cavity tool molding glass-filled PBT/ASA parts, each with a different surface finish or texture, in a 20-sec total cycle time on a KraussMaffei injection machine. This is a game changer, as now you can make defect-free parts and not sacrifice productivity. We have not seen any other heating method able to heat and cool so quickly and with such accuracy and control.

The final challenge for H&C technologies is the ability to integrate heating elements into a complex tool. Our flexible induction coils are available in many diameters and can now be integrated into complex tooling, as we illustrated at NPE2018 in displaying a hemispherical polycarbonate part.

INDUCTION HEATING, TURBULENT COOLING

Roctool's patented technology consists of designing a H&C mold layout in order to provide fast and homogeneous heating. Flexible inductors can follow any complex tooling shape.

A high-frequency current is generated to run through the inductors, creating eddy currents and a joule effect to heat the mold surface up to 1000 C (1832 F) at rates up to 25° C (45° F) per second. What's more, the heating is applied only to the cavity surface rather than the whole mold half, minimizing energy consumption. Using standard water-cooling channels and ensuring a fully turbulent flow rate enable efficient cooling of the tool.



Roctool's growing database shows the increased flow length possible for various resins with induction-based H&C technology.

Heating and cooling are both controlled automatically with aid of thermocouples in the mold. Mutiple heating zones can be accommodated. This technology works with P20 and other conventional mold steels and with any type of injection press.

Why They Switched

Three case histories of customers that switched from other molding methods to rapid H&C with Roctool induction technology.

CASE #1: DEKKO

Electronic OEM Dekko, based in Garrett, Ind., produces high-gloss electrical and USB power packs. Before using H&C technology, Dekko had to deal with part defects and surface imperfections such as knit lines, flow lines, gate blush, and splay.

Dekko chose Roctool induction H&C over other technologies for two main reasons: First, H&C offered a cost-benefit vs. changing the part design to achieve what was required with traditional tooling. Second, Dekko uses a variety of molded-in colors, and Roctool H&C technology provides excellent surface quality that avoids the need for paint.

Dekko uses Roctool H&C technology to mold USB power packs, in large part because of the superior surface quality.

"The benefits for us have been largely in the final part appearance, with the elimination of surface defects. Roctool helps us to open the design window to make things feasible that were not achievable for us before,"states Jerry Zawadzde, Dekko program manager.

CASE #2: FLEX

Flex, based in San Jose, Calif., has used all types of H&C technologies for many years, including heating with steam, pressurized water, and electrical cartridges. Flex began working with Roctool after the K 2010 Show in Dusseldorf. The first Flex mold equipped with Roctool technology was for a very thin electronic e-reader/tablet housing. Induction H&C technology was able to fill the part completely, reduce cycle time, and cut energy consumption, thereby outperforming pressurized hot water.

Flex changed to Roctool induction technology for several reasons, including that it is a clean, safe system offering faster cycle times, lower energy consumption, limitless material possibilities, better temperature control, and low corrosion on molds.

Flex faced challenges in changing to Roctool technology—mainly convincing technicians and other coworkers to try something new and different. But Flex is looking to use Roctool H&C technology in the future to be able to process all types of materials, including carbon-fiber composites and new product designs through lightweighting and in-mold decorative effects on high-value parts. "Roctool can be environmentally friendly due to eliminating the need for secondary operations, and is very safe for operators, which comes at no extra price," explains Sebastien Ignotis, director of Advanced Engineering at Flex.

Flex molded this two-piece, snap-fit sphere of glass-filled PC with Roctool H&C technology, demonstrating the adaptability of flexible induction heaters to complex part shapes.

A complex 3D shape molded by Flex demonstrates some of the capabilities of induction-based H&C molding. Exhibited by Roctool at NPE2018 last month, the product is a sphere composed of two snap-fit parts, one of which has multiple oblong holes of different sizes and a curved depression in the top. It is molded of 10-50% glass-filled PC and has thin walls, high gloss, and a molded-in logo. The part is center-gated behind the logo, but the H&C process leaves no sink mark or blemish. This product design is used by Flex for both a room scent diffuser and a Bluetooth audio speaker.

CASE #3: DEDIENNE

Dedienne Multiplasturgy Group in France was one of Roctool's first users. This diversified custom plastic processor wanted to maintain its leadership in an evolving market and anticipate the needs of its customers in terms of innovation and differentiation.

Dedienne uses Roctool H&C technology for both injection and compression molding. Increased efficiency in compression molding of high-performance materials at high temperatures has made them accessible for mass production. Normally, these materials are reserved for short runs because their processing requires a large amounts of labor and long cycle times. Thanks to rapid induction heating, Dedienne is able to produce a part in a few minutes that would have taken hours otherwise.

According to Matthieu Crepin, Dedienne's deputy managing director, Roctool is a technology provider and source of design support since it formed a design team last year. These resources have accelerated Dedienne's deployment of injection molded high-heat materials, especially in the U.S. market with Dedienne's Met2Plastic subsidiary based in Chicago, which has implemented the Roctool induction technology process. "By opening their own design offices, Roctool has responded to some of our main challenges. We are very much looking forward to the benefits of this new approach for high-heat materials," Crepin says.

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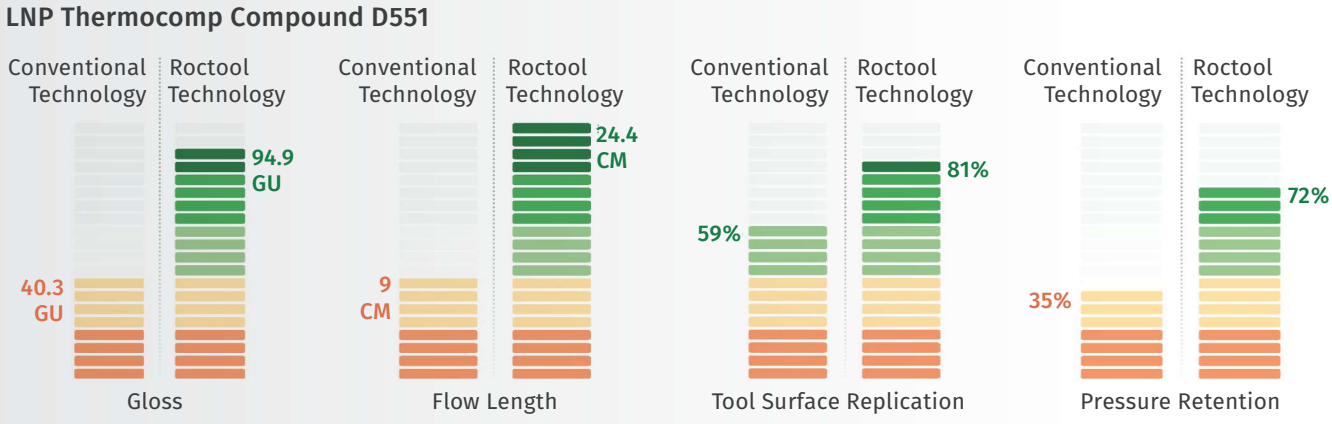

A snapshot of part of Roctool's resin database shows improved results possible with SABIC's LNP Thermocomp D551 compound of 50% glass-filled PC.

The ability to heat the mold quickly and fully control temperature distribution opens up new molding possibilities, including shorter cycles, increased part quality, and longer flow lengths. The hot mold can impart a Class A finish or replicate the finest surface texture. It is now also possible to fully simulate the H&C process with induction heating using Autodesk Moldflow software (***autodesk.com***).

SABIC, a major global producer of plastics and chemicals with U.S. headquarters in Houston (***sabic.com***), has collaborated with Roctool for many years. Combining Roctool's induction-based H&C technology with SABIC's broad materials portfolio has helped to push the performance and aesthetics of finished parts to a higher level and opens up new application opportunities.

Using Roctool technology, SABIC has demonstrated the ability to achieve a glossy finish on injection molded parts with materials that have historically presented challenges with regard to surface appearance—such as 30% glass-filled Ultem 2300 polyetherimide (PEI), and 50% glass-filled polycarbonate (Thermocomp D551). Additionally, SABIC validated the possibility of combining a low-gloss effect, using texturing, with a high-gloss effect in the same part—a cosmetic effect that appeals to designers.

A new and growing materials database identifies the benefits of induction H&C molding with different resins.

DEVELOPING A DATABASE

SABIC is now supporting Roctool's initiative to quantify the effects of induction H&C technology using the HD Plastics Database. Creating a central repository of relevant data on surface replication, weld-line strength and flow length with different materials can provide specific data points to help customers understand the levels of improvement in parts that can be achieved with this H&C technology.

The material characterization is part of Roctool's ongoing work with resin providers to develop the HD Plastics material database, which is designed to help OEMs achieve exceptional part quality and increased performance. Roctool is constantly adding new providers and materials to grow and reinforce this source of information, which is currently available only to Roctool users but in future will be available to others with a subscription. One snapshot from that database is pictured above.

NEW IDH COMPOSITE TECHNOLOGY

IDH stands for "Induction Dual Heating," a new technology for molding parts combining a continuous-fiber thermoplastic composite blank and injection overmolding with additional thermoplastic compound. Such "hybrid" composites are gaining interest because they offer light weight, high strength and stiffness, and design freedom to overmold 3D details and provide surface aesthetics without secondary finishing—and all within a 60-sec cycle time.

Current hybrid composite overmolding processes generally utilize an infrared oven for preheating a consolidated thermoplastic "organosheet" and then transport the softened sheet via robot and/or conveyor to the cold mold. IDH technology uses a single induction generator for the entire process. It starts with robotic placement of a cold composite insert in the tool, which is already heated by the induction generator. Meanwhile, a small amount of power is sent to second, small induction heating station to heat up a sheet of solid graphite of the same size as the composite insert. The robot takes the hot graphite sheet from the induction station and places it close to the exposed "B" side of the composite insert in order to heat that second surface by radiation. The composite insert is then

stamped to the desired shape, the mold opens, and the mold half with the composite insert rotates into the injection station for overmolding. The induction generator switches power from the stamping mold to the injection mold and back again.

Induction Dual Heating is a new approach to hybrid composite overmolding that eliminates infrared preheating, saving energy, cycle time, and machine footprint.

Induction heating is more efficient than infrared and can heat to higher temperatures. Replacing the usual infrared preheating of the organosheet before placing it in the mold eliminates the difficulties of handling and precisely positioning a floppy piece of hot organosheet. It also avoids the problem of the preheated insert cooling during transfer. IDH is able to control the heating of both elements in an intelligent way, by adapting the heating time and power automatically. This system is also much more compact and thereby meets the constraints of the electronics sector.

IDH provides a resin-rich surface, is adapted to complex geometries, and can utilize nonwoven and sandwich composite inserts, which can be more difficult to handle when hot in the conventional process. What's more, IDH can even use non-consolidated sheets, saving a processing step and potentially reducing the cost of composite raw materials. IDH can provide multi-zone heating at temperatures up to 400 C (752 F), and is suitable for both thermoplastic and thermoset materials.

Based on the example of a 14-in. laptop cover, 1 mm thick, of PC with 50% carbon fiber, IDH has been shown to provide these advantages:

- 40% shorter cycle time of 60 sec, vs. 100 sec with conventional hybrid composite molding.
- 54% lower energy consumption (2.3 kWh vs. 5.0 kWh) utilizing the same process-temperature range.
- 28% smaller footprint, using the same vertical injection machine and six-axis robot. PT

ABOUT THE AUTHOR Mathieu Boulanger joined Roctool in January 2004. In 10 years at Roctool headquarters in France, he was responsible for global sales, key accounts, and strategic marketing of the company's technologies, which he helped introduce into such markets as automotive, electronics, consumer products, and aerospace. In 2013, Matt started developing the North American subsidiary for Roctool, now based in Charlotte, N.C. In 2015, Matt was named Roctool CEO.

PT Keeping Up With Technology

PRODUCT FOCUS **Auxiliary Equipment**

MATERIALS HANDLING

Teflon-Coated Sensor Sheds Sticky or Staticky Materials

The Teflon-coated sphere for the SmartBob level sensor from BinMaster, Lincoln, Neb., is a new option for bins, tanks, or silos containing powders or particles that may adhere to the sensor due to stickiness or static attraction. Buildup of particles on the gravity probe can require maintenance for cleaning. The Teflon coating on the sphere is FDA approved for food contact.

800-278-4241 • binmaster.com

MATERIALS HANDLING

Low-Velocity Conveying System Reduces Pellet Friction

The newly developed Fluidlift ecoblue from Coperion, Sewell, N.J., is billed as a quality- and efficiency-enhancing pneumatic-conveying process for pellets. Compared with conventional designs, the process reportedly generates much less dust and streamers, which improves the quality of the product and reduces waste. Its lower power consumption also allows materials suppliers and compounders to reduce costs or increase throughput. Under industrial conditions it has been shown to reduce the formation of dust and streamers by 50% to 98% while lowering pressure loss in the conveyor system and energy consumption by 17% to 35%.

Coperion presented the new process, which is suitable for both new installations and retrofitting existing systems, for the first time worldwide at NPE2018 last month. The key to significantly reducing both attrition and pressure loss—the pressure difference between product feed and product delivery—is a controlled increase in the relative humidity of the conveying gas. Coperion's primary objective while developing Fluidlift ecoblue was to prevent any end-product damage by minimizing the amount of moisture introduced and subsequently removing it. The result of this is that the granulate can be conveyed at a very low velocity, so friction between the grains and at the wall of the pipe is substantially lower than in previous designs. Ultimately, this new process ensures a dry, almost dust-free product without any need for complex additional measures.

Dry/Conventional

Fluidlift ecoblue

Coperion says Fluidlift ecoblue offers an alternative wherever attrition-sensitive products are conveyed, and the generation of dust is undesirable or might even interfere with subsequent processing of the manufactured pellets. This extends the range of applications from bulk plastics to high-performance compounds. The new process is said to be particularly advantageous when handling products for upmarket technical applications such as films, high-purity granulates, and optical components.

856-589-0500 • coperion.com

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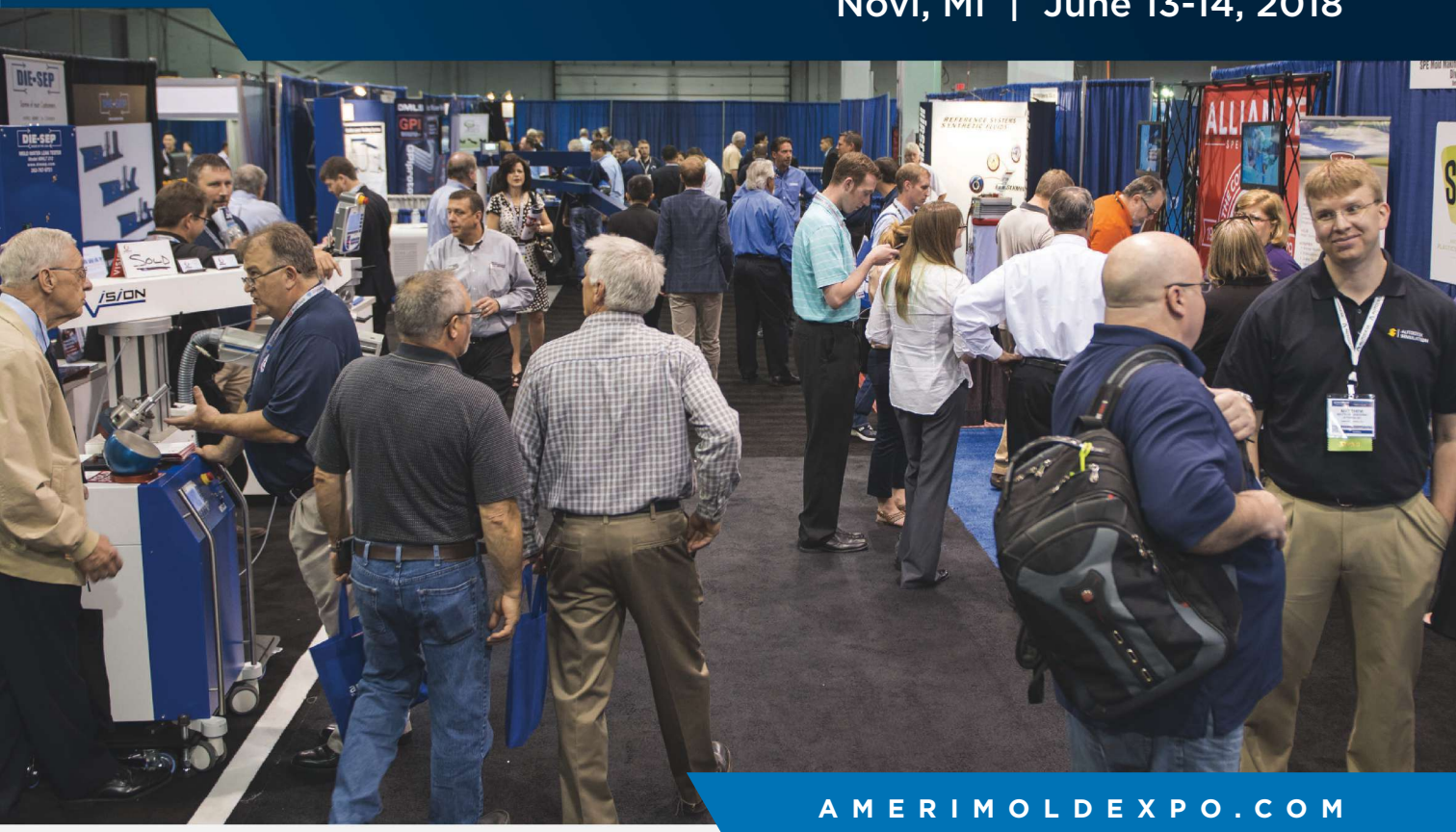

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TESTING

FTIR Spectrophotometer Boasts Added Versatility & Reliability

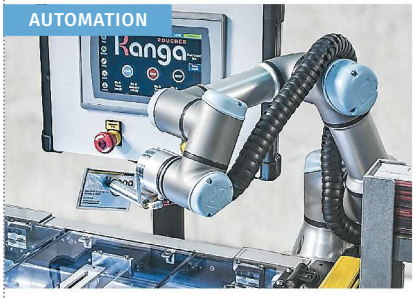
A new FTIR (Fourier Transform Infrared) spectrophotometer that reportedly provides unmatched functionality in its class of compact instruments was showcased at NPE2018 last month by Shimadzu Scientific Instruments (SSI), Columbia, Md. The IRSpirit, the company's smallest and lightest FTIR unit, is also said to offer exceptional reliability in contaminant analysis, identification tests and quantitative measurements.

The user-friendly IRSpirit comes with an IR Pilot assistant program, an identification-test and a contaminant-analysis program. This program is comprised of 23 applications that give analysts the ability to measure samples and print results with a few mouse clicks. IR Pilot is said to allow operators with minimal analytical knowledge to obtain results quickly by selecting the proper accessory and sample form.

The unit accommodates existing Shimadzu and third-party accessories such as ATR and diffuse reflectance, as well as transmission accessories such as KBr pellet holder and demountable cells. This instrument includes a sealed interferometer that protects the beam splitter from both air and moisture, and also houses electrical and paper-based humidity indicators, which work in tandem with LabSolutions IR software to help users easily monitor the status of the unit in high-humidity environments.

800-477-1227 • ssi.shimadzu.com

AUTOMATION



'Cobot' Pioneer Makes NPE Debut

A first-time exhibitor at NPE, Universal Robots of Denmark (with three U.S. regional offices), was at the show last month to address the growing interest among plastics processors in the new automation category of "collaborative" robots and to educate them in how they can be used to free up workers from repetitive pick-and-place tasks. "Our product is uniquely positioned to address the pain points of plastics manufacturers, such as tightening labor markets, rapidly changing production lines, and the need to constantly lower overhead costs," says Brian Dillman, area sales manager for Universal Robots (UR; ***universal-robots.com***).

Besides modest cost and easy programmability, a standout feature of these "cobots," as some are now calling them, is that they "reduce or eliminate the need for guarding, which means a significantly reduced footprint. They stop safely on operator contact and can be moved with minimal force" according to Sean Dotson, president and CEO of RND Automation & Engineering, Sarasota, Fla., a UR partner (***rndautomation.com***) that is exhibiting its new Kanga Poucher in the UR booth. Kanga (above left) is a vertical form/fill/pouching system that forms four-sided pouches from film for medical devices, pharmaceutical packaging, and durable goods. In the booth, a small UR cobot is feeding products into the system.

A second demo at the UR booth involves a bulk box loader from Dyco Inc., Bloomsburg, Pa. (***dyco-inc.com***), a firm that specializes in automated systems to move and pack plastic bottles (above right). It uses a "guardless" UR cobot to grab a row of bottles—commonly by the necks—off a conveyor and transfer them to a box or tray. The company also makes palletizers. The safety of working around UR cobots enables an operator to remove a fully packed box while the cobot starts filling another. The box loader is controlled from the UR cobot interface. The system is designed for easy setup on a self-contained plate that can be moved among multiple blow molding lines running different bottle and box sizes.

INJECTION MOLDING

New Electric Series with Enhanced Specs & Controls

At NPE2018 last month, Toshiba Machine Corp., Elk Grove Village, Ill., introduced a new generation of all-electric presses, the ECSXIII series (successor to the ECSXXII line), which was displayed in four models from 110 to 390 tons. They offer a streamlined frame design, re-engineered toggle-clamping system, "significantly faster" injection speeds, and quick-change, removable platens, the company notes.

Also introduced with these machines was the Injectvisor V70 controller (successor to the V50 on the previous machine series). It boasts more memory, graphics and customizable inputs than previous versions, along with sequences that are easier to configure, according to the company. On one machine, the controls for the Sepro robot and Mold-Masters hot runner were integrated into the V70 controller.

Also shown at NPE was Toshiba's energy-efficient TiAS servo-hydraulic press in a 250-ton model. All five machines were connected to Toshiba's iPAQUET data-acquisition system and displayed on a communication hub at the center of the booth. The hub also displayed Toshiba's Euromap 77 dashboard and V70 simulator. Euromap 77 is the newly finalized standard for the interface between molding machines and MES (manufacturing execusion systems) computers. It is based on OPC-UA and is part of the emerging framework of standards designed to facilitate the emergence of Industry 4.0 "smart factories."

888-593-1616 • toshiba-machine.com

MATERIALS

Purging Compounds for Polyolefins and Engineering Resins

Two new purging compounds for thermoplastic injection molders were presented at NPE2018 as the latest additions to the Ultra Purge product line by Chem-Trend, Howell, Mich. Both are ready-to-use granular compounds designed to clean barrels, nozzles and hot runners.

Ultra Purge 5150 is recommended for cleaning polyolefin resins, while 5160 compound is designed for engineering resins. Each product is said to be highly efficient as well as safe for operators and equipment.

800-323-7771 • chemtrend.com

EXTRUSION

Cost-Performance Options Expand In Cast-Film Dies

Nordson Corp., Chippewa Falls, Wis., has adapted an extrusion die technology that has been in global use for 15 years and now offers it under the new name Uniflow. Billed as an alternative for cast-film applications that do not call for the special capabilities of the widely used EDI Contour die, the Uniflow die was first developed by the Belgian firm Verbruggen, which Nordson acquired in 2011.

The Uniflow die reportedly provides an affordable option for high-speed processing of thermally stable resins with very few rate changes, such as for stretch film. Its versatile flow channel accommodates a broader range of resins and processing parameters. It has an elongated teardrop manifold cross-section that is said to promote uniform layers in coextrusion. Its mechanical stability is said to be outstanding, which reduces the changeover time between product runs.

715-726-1201 • nordson.com

COMPOUNDING

Novel Mixer & 'Intelligent Compounding' Platform

The Omega co-rotating twin-screw compounding extruder from Steer America, Uniontown, Ohio, is equipped with the firm's Fractional Lobe Processor (FLP) to significantly enhance mixing and melting capabilities. Steer says the device can "work on materials in the solid state to achieve intimate interaction between the constituents while imparting physicochemical changes through reaction, devolatilization, shear, compression, elongation, surface renewal, distribution, dispersion."

The FLP reportedly provides the required uniformity in a three-dimensional force field, eliminating hot zones that could result in material degradation. This can be shown by mathematical models using analytical methods or computational fluid dynamic models based on finite-element analysis. The FLP is also said to eliminate meta-radial shear, thus achieving stable and improved process control in compounding materials.

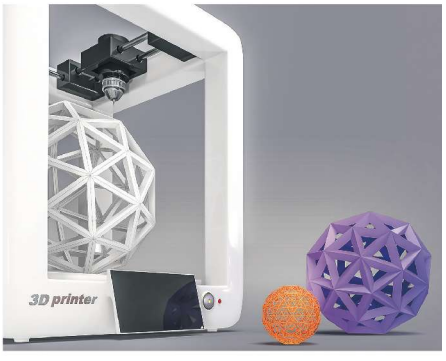
At NPE2018 last month, Steer also demonstrated more than 20 applications demonstrating process advantages gained by adopting "Intelligent Compounding." The demonstration tackled various process challenges, such as dispersion, feeding, pressure control, shear, wetting, dust management, retention, distribution, temperature, increased output, residence time, devolatilization, and moisture content.

866-984-1800 • steeramerica.com

ADDITIVE MANUFACTURING

First Nanodiamond-Enhanced Filaments For 3D Printing

Finnish nanodiamond manufacturer Carbodeon Oy (represented in the U.S. by Silicon Sense Inc., Nashua, N.H.) and Dutch 3D-printing specialist Tiamet 3D have launched what is said to be the world's first nanodiamond-enhanced filaments for 3D printing. The Carbodeon/Tiamet filaments are based on a jointly patented technology that is said to significantly improve the mechanical and thermal properties of 3D-printed items. Nanodiamonds are said to have potential to make 3D-printed components that perform as well as, or better than, comparable injection molded components, but with massive cost reductions and production speed improvements, especially for prototypes and on-demand or short-run production.



Targeted on electronics, automotive and aerospace industries, among others, the first Carbodeon/Tiamet 3D filaments are PLA-based, with further developments to be focused on higher-performance thermoplastics. The companies have formed a strategic partnership in joint filament development, along with an agreement for Carbodeon to supply nanodiamond materials to Tiamet 3D. The filaments are available from both Carbodeon and Tiamet 3D and are sold under the uDiamond brand.

603-891-4248 • siliconsense.com

ADDITIVE MANUFACTURING

3D Printing Filaments in PVDF & PEKK

Manufacturer of premium 3D-printing filaments 3DXTech LLC, Byron Center, Mich., is launching filaments based on Kynar PVDF and semi-crystalline Kepstan PEKK from Arkema, King of Prussia, Pa. (***arkema.com***). The new Firewire filaments are available in 1.75- and 2.85-mm diameters.

Kynar PVDF has been used for decades in demanding industrial applications that require outstanding resistance to a wide range of aggressive chemicals. It exhibits high thermal stability up to 302 F/150 C and extreme durability in direct sunlight exposure. Kepstan PEKK is an extreme-performance thermoplastic with a highly stable chemical backbone. Its semi-crystalline structure reportedly offers an outstanding combination of mechanical and thermal strength together with tremendous chemical and fire resistance. Kepstan PEKK filaments are said to offer both ease of printability and the highest performance of any thermoplastic material currently available.

616-901-1561 • 3dxtech.com

MATERIALS

Family of PEBA-Based TPEs

An extended product family of nylon-based TPEs, also known as polyether-block-amides (PEBA), was showcased at NPE2018 last month by Nylon Corporation of America Inc., Manchester, N.H. Targeted to a range of applications in automotive, sporting goods, personal electronics, composites, and specialty films, the NyFlex elastomer range is available in hardnesses from 82 Shore D to 90 A. They have lower specific gravity than TPUs and are easily processed.

NyFlex is characterized by a nylon block, which is the hard segment, and the polyether block, which is the soft, flexible segment. By varying the type and the ratio of these two blocks, a wide range of grades is said to offer excellent flexibility at low temperature, superior retention of properties at elevated temperature, and exceptional toughness and resilience. High creep resistance, strong resistance to flex fatigue, good abrasion resistance, and superior resistance to grease, oils, and solvents are also claimed.

603-627-5150 • nycoa.net

Commodity Resin Prices Mostly Flat to Down

PET and, possibly PP, are the exceptions.

By Lilli Manolis Sherman
Senior Editor

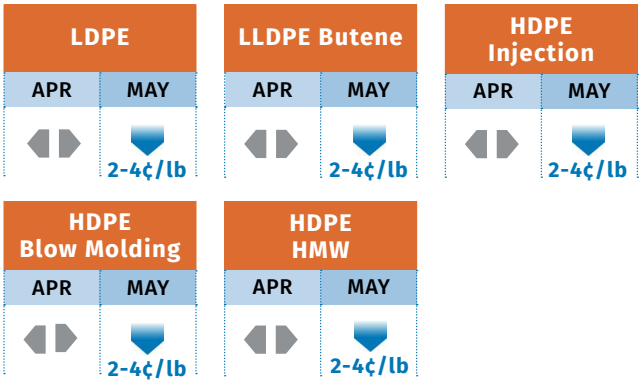
Prices of five large-volume commodity resins generally were trending flat-to-down in April and into May and possibly this month—except for PET, which was on the way up in May. In the case of PET, higher crude-oil prices had driven PET feedstock prices up. As for the other four resin families, key drivers were improved supply; a drop in feedstock costs—dramatic in the case of ethylene; and, in some cases, domestic and export demand that didn't meet expectations due to weather and other issues through much of the second quarter. Prices of PP could also buck the trend somewhat, as suppliers aimed for margin-expansion increases after a double-digit price decline.

These are the views of purchasing consultants from Resin Technology, Inc. (RTi), Fort Worth, Texas (*rtiglobal.com*); CEO Michael Greenberg of the Plastics Exchange in Chicago (*theplasticsexchange.com*); and Houston-based *PetroChemWire* (*PCW, petrochemwire.com*).

PE PRICES FLAT OR LOWER

Polyethylene prices were flat in April and were largely expected to remain flat or go lower. Suppliers pushed unsuccessfully to implement their March 3¢/lb price hike in April, with at least one delaying it to May 1, while there was market talk of lower prices last month. Mike Burns, RTi's v.p. of client services for PE, ventured that May PE prices would likely drop 2-4¢/lb.

Polyethylene Price Trends



Market Prices Effective Mid-May 2018

Resin Grade	¢/lb
POLYETHYLENE (railcar)	
LDPE, LINER	101-103
LLDPE BUTENE, FILM	87-89
NYMEX 'FINANCIAL' FUTURES	48
JUNE	48
HDPE, G-P INJECTION	103-105
HDPE, BLOW MOLDING	93-95
NYMEX 'FINANCIAL' FUTURES	50
JUNE	50
HDPE, HMW FILM	110-112
POLYPROPYLENE (railcar)	
G-P HOMOPOLYMER, INJECTION	76-78
NYMEX 'FINANCIAL' FUTURES	57
JUNE	57
IMPACT COPOLYMER	78-80
POLYSTYRENE (railcar)	
G-P CRYSTAL	113-115
HIPS	119-121
PVC RESIN (railcar)	
G-P HOMOPOLYMER	83-85
PIPE GRADE	82-84
PET (truckload)	
U.S. BOTTLE GRADE	74-76

PCW reported PE spot prices as flat to lower and characterized supply as balanced for most grades, except for certain LDPE and HMWPE film resins. *PCW* also reported that domestic spot buyers were inactive, but that underlying demand was good. The Plastics Exchange's Greenberg put it this way: "Buyers were quiet, sensing no real threat of rising prices as suppliers pushed off their April increase, shedding doubt on any success in May." Both *PCW* and Burns noted that PE plants were operating at good rates—low 90% range—with inventories building as a result.

"I don't think a price hike can be achieved for the rest of the year, barring oil prices spiking significantly, meaning 10-15% or $7-10/bbl above current prices—or false demand in the third quarter due to pre-hurricane season, or actual hurricane-related production disruptions." He also noted that there will be a notice-

able improvement in resin availability beginning in the third quarter. "Most suppliers will have caught up from hurricane Harvey disruptions and post-hurricane unplanned outages."

Oil prices, which have driven PE pricing trends, have increased 30% or $15/bbl in the past year. Natural gas prices were 10% lower during the same time period. Spot ethylene prices hit a new low of 13¢/lb by the end of April, after three straight weeks of prices near 10-year lows, according to Burns. Meanwhile, since July of last year, processors with contract negotiation opportunities saw their prices increase 5-7¢/lb, and for others, as much as 11¢/lb. Burns ventures that PE suppliers' margins grew to about 30¢/lb as their costs didn't go up.

PP PRICES BOTTOM OUT

Polypropylene prices in April generally were flat to down 1¢/lb in step with propylene monomer contracts. Though some industry sources reported a 1¢/lb margin-expansion increase at some accounts, RTi's v.p. of PP markets Scott Newell maintained that such occurrences were not widespread, and said he saw April PP prices dropping by 1¢ with the monomer in most cases.

Polypropylene Price Trends

Homopolymer	APR	MAY
	1¢/lb	1-2¢/lb

Copolymer	APR	MAY
	1¢/lb	1-2¢/lb

PCW reported that spot PP prices were higher amid tight supply and healthy demand. Similarly, Greenberg reported high activity at the end of April, venturing that buyers were recognizing upward pressure on contract pricing and aimed to secure material beyond their current needs. All three sources reported that spot monomer prices began to move up due to planned and unplanned outages that have kept supply snug. Newell ventured that May monomer contracts had the potential to settle 1-2¢/lb higher.

PP market fundamentals may not support a price increase now, but suppliers may eke out a small margin-expansion upcharge.

For PP, Greenberg said some of the 3-5¢/lb margin-expansion increase will likely take hold in the second quarter, despite a steady flow of fresh offers on the spot market. Newell ventured that in addition to the potential monomer increase, PP suppliers could get a 1-2¢ margin expansion in May. "When I look at the PP market fundamentals, I don't see the market supporting an increase. So far this year, demand has been flat to slightly down. In fact, we have had an eight-month run of below-average demand." While he expected fairly decent demand for May, Newell rejected industry reports that the market is very snug: "The market is not loose but it's not too tight either—and the numbers simply do not show the purported tightness." Plant operating rates in first quarter were only 84-85%, yet there was a supplier inventory buildup of 70 million lb. PP imports have been above average since Hurricane Harvey, which accounts for a piece of the lost domestic demand. Newell saw about 1.2% negative domestic growth in the first quarter. He noted that supplier inventories are a well-balanced 31.3 days.

PS PRICES DOWN

Polystyrene prices were flat in April and several suppliers notified customers of 2-4¢/lb decreases for May 1, according to RTi's Kallman. Both Kallman and PCW attribute the downward trend to a couple of key drivers. First, feedstock prices had dropped significantly—on the order of 6¢/lb. Benzene contract prices dropped from a peak of $3.30/gal in December to $2.93/gal in May. Ethylene spot prices plummeted from around 27¢/lb in early January to 13¢/lb in the last week of April. Late-settling ethylene contracts were expected to be down by 2¢/lb. And styrene monomer spot prices had returned to early January levels by May, according to *PCW*. Moreover, the strongest season for PS consumption saw weather-related delays while supply was well balanced. For this reason, Kallman ventured that PS prices this month, following the May decreases, were likely to be flat, and suppliers need to share more of the lower feedstock costs with the market.

Polystyrene Price Trends

GPPS	APR	MAY
		2-4¢/lb

HIPS	APR	MAY
		2-4¢/lb

PVC PRICES DOWN TO FLAT

PVC prices were reported by one industry index to have dropped by 2¢/lb in April—nixing out the March increase, though it appeared to be somewhat of a mixed bag, more like flat-to-down, according to Mark Kallman, RTi's v.p. of client services for engineering resins, PS and PVC. Kallman predicted PVC prices in May would be flat-to down and to stabilize this month, as seasonal demand for PVC was expected to be robust.

PVC Price Trends

Pipe	APR	MAY
	2¢/lb	

Gen. Purpose	APR	MAY
	2¢/lb	

Both Kallman and *PCW* cited ample supply, lower feedstock costs, particularly ethylene, and a drop in exports through the second quarter for the soft pricing trend. ►

However, Kallman noted that PVC suppliers' operating rates are up in the 90% range since March due to low feedstock costs and are expected to remain there, with both domestic and export demand strengthening.

PCW reported that pipe converters had supported both the February and March price hikes in the expectation that it would allow them to push up pipe prices. In contrast, those not in the pipe side of the business felt the March 2¢/lb increase should never have been implemented, as both ethylene prices and PVC export prices were dropping in March.

PET prices are seeing upward pressure from rising feedstock prices and imposition of new anti-dumping duties on some imported resins.

PET PRICES UP

PCW reported that domestic bottle-grade PET resin prices in April were steady at March levels of about 73¢/lb truckload and railcar delivered Midwest. At the same time, higher crude-oil prices in April pressured PET feedstock prices higher. This was expected to result in domestic PET prices rising 2-3¢/lb in May—especially for monthly contracts tied to average feedstock costs.

Meanwhile, U.S. PET import prices stood at 70-71¢/lb delivered duty-paid (DDP). These prices were also rising by the end of April, due to anti-dumping (AD) duties imposed on PET imports from Brazil, Indonesia, South Korea, Pakistan, and Taiwan—which accounted for about 40% of PET imports in 2017.

PET Price Trends

Bottle Grade	
APR	MAY
◀▶	▲ 2-3¢/lb

The U.S. Commerce Dept. announced on May 1 that it had imposed these AD "margin" rates as follows: Brazil, 24.09-226.91%; Indonesia, 13.16%; South Korea, 8.81-101.41%; Pakistan, 7.75%; Taiwan, 9.02-11.89%. Cash deposits equaling the assigned percentage of the value of a given load must be posted with U.S. Customs and Border Enforcement before being cleared for entry.

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Plastics Processing Closes Best Quarter in Recorded History

Overall index for April hits 58.1; custom processors climb to 62.4.

By Michael Guckes
Chief Economist

Registering 58.1 for April, the Gardner Business Index (GBI): Plastics Processing finished slightly above March's 57.7 reading. Compared with the same month one-year ago, the index has increased by 11.1%, though it should be noted that the April 2017 reading was one of the lower readings recorded in that calendar year.

For the current month, the index was driven higher by production and new orders. Supplier deliveries, backlogs, employment and exports all pulled the averages-based index lower. All components of the index experienced growth during the month as exports again moved into expansionary territory.

Notable events in April's data include strong expansionary readings for both production and new orders. Since the beginning of the year, the Plastics Processing Index has recorded four consecutive months of atypically robust growth in new orders. Simultaneously, production growth is currently at record-setting levels. The three-month moving average of production readings ending with April is higher than at any time in recorded history. The faster expansion of production relative to new orders may explain why backlog readings have been relatively tame by comparison.

Among only custom processors, the April index of 62.4 was its highest reading in history. Growth among custom processors has continually accelerated since October of 2017.

Michael Guckes is the chief economist for Gardner Intelligence, a division of Gardner Business Media, Cincinnati. He has performed economic analysis, modeling, and forecasting work for nearly 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

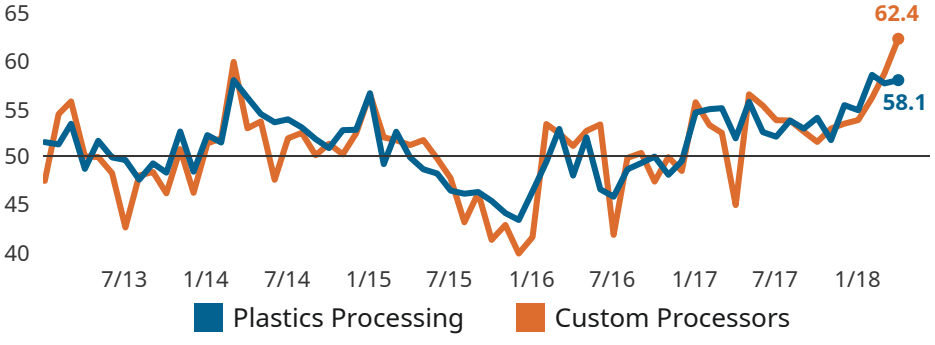


FIG 1

The Plastics Processing Index reading registered its sixth consecutive increase for the month ending in April, setting a record high. Custom processors enjoyed a record-setting month.

Gardner Business Index: Plastics Processing – Production & New Orders

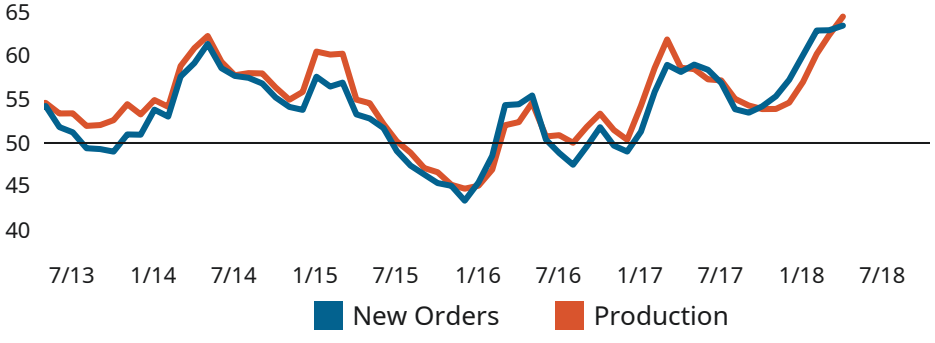


FIG 2

New orders and production both experienced strong expansionary trends, starting in the fourth quarter of 2016, and have continued to expand month after month at these elevated levels through April. In the face of strong new orders demand, plastics processors have done a commendable job of controlling backlog growth.

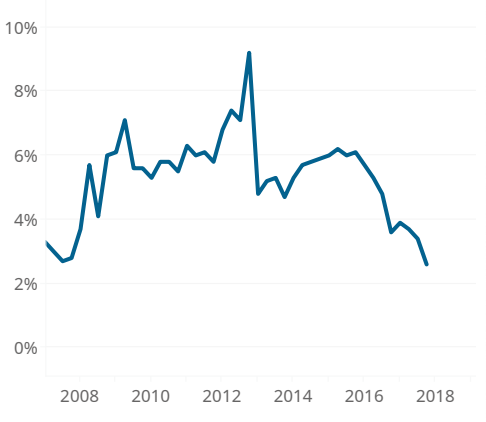
Consumer Products Industry Grows As Consumer Spending Increases

Wall Street expects strong earnings growth among these companies in 2018.

By Michael Guckes
Chief Economist

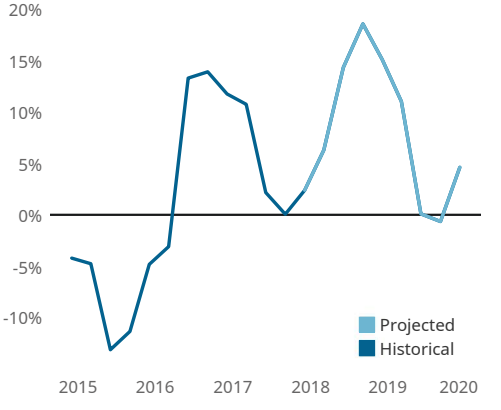
Consumption spending by Americans rose 2.8% for the year ending February 2018, according to the Bureau of Economic Analysis. The latest available data on wages, overtime and employment all indicate that in 2017 and the initial months of 2018, workers on average experienced increasing incomes. Simultaneously, the U.S. Personal Savings Rate decreased from 3.6% during the fourth quarter of 2016 to 2.6% in the last quarter of 2017. This is important because income not deferred to savings is assumed to be spent in the present. For reference, the average savings rate since 2007 has been 5.3%, and 8.5% since 1947.

U.S. Personal Savings Rate Declining



Strong economic growth in the U.S. and globally has resulted in rising wages, greater hours worked, and plentiful jobs. These factors may partly explain the falling U.S. savings rate and thus greater rate of consumption by consumers.

Consumer Products Companies Growing (% Change in Earnings)



Among 60 consumer-products firms monitored and forecasted by various equities analysts, projections for Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA) are expected to grow strongly during the first half of 2018.

Strong consumer-confidence survey results likely explain why consumers have been spending more and saving less. According to the Conference Board's survey results, respondents' outlook on their present situation—measuring current business and employment conditions—are more positive now than at any time since 2000, including the period just prior to the Great Recession of 2008. Similarly, the Board's survey of expectations—measuring expectations for six-months from now—are also at highs last recorded in the late 1990s and early 2000s, and above levels experienced prior to the Great Recession. Gardner Intelligence notes that since the start of 2017, the current-situation index has increased faster than the more forward-looking expectations index.

Increases in wage and hours worked, combined with a reduced savings rate during 2017, set the backdrop for strong 2017 revenue growth of 5.2% among nearly 60 publicly traded consumer-products firms tracked by equity analysts on Wall Street. Wall Street revenue projections for these same firms in 2018 and 2019 are 4.7% and 3.5% respectively. Gardner Intelligence believes that the lower projections of revenue growth will be a result of savings rates increasing to a point closer to their long-run averages. Conversely, should wages and work-hours show even stronger than anticipated advances in 2018 and 2019, revenue projections could be upwardly revised.

Strong revenue and earnings projections for the consumer-products industry, coupled with solid 2017 growth, may explain why capital expenditure levels among sector firms during 2017 were 6.6% higher than the same period a year ago. Comparable capital expenditure growth in 2016 and 2015 was 2.8% and -1.1% respectively. It also bodes well for processors supplying these firms with parts and components.

ABOUT THE AUTHOR: Michael Guckes is the chief economist for Gardner Business Intelligence, a division of Gardner Business Media (Cincinnati, OH US). He has performed economic analysis, modeling and forecasting work for nearly 20 years among a wide range of industries. Michael received his BA in political science and economics from Kenyon College and his MBA from The Ohio State University. *mguckes@gardnerweb.com*

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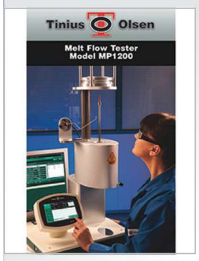

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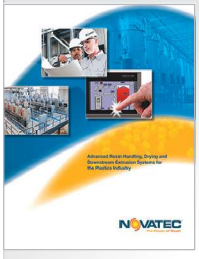

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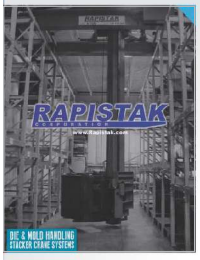

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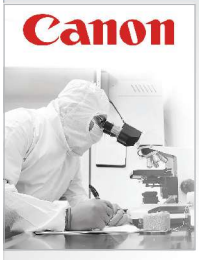

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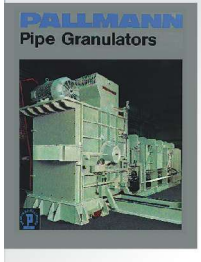

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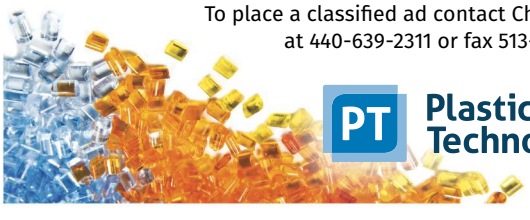

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HUBER+SUHNER AG — PFAFFIKON, SWITZERLAND

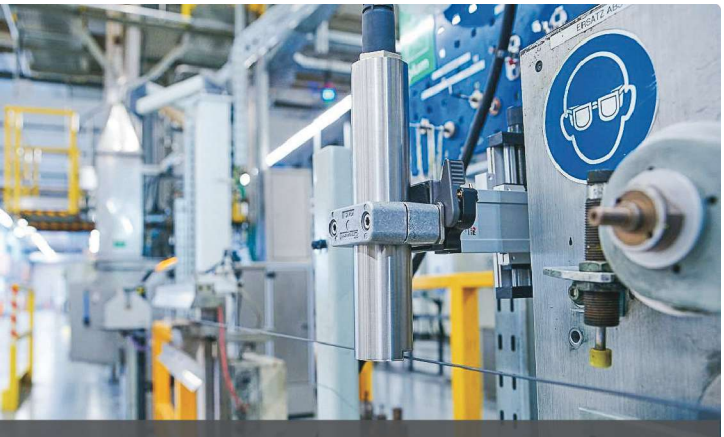
Inline Inkjet Printer Keeps Pace With Speedy Wire & Cable Processor

Huber+Suhner is outfitting its six high-speed extrusion lines with new high-speed, continuous inkjet printers.

By Lilli Manolis Sherman
Senior Editor

What appears to be one of the world's fastest continuous inkjet (CIJ) printers is enabling a wire and cable processor to boost the production and printing quality of its electrical and optical communications products. Switzerland's Huber+Suhner AG (H+S) has installed a new inline JET Rapid CIJ printer from Germany's Paul Leibinger GmbH & Co., (U.S. office in East Troy, Wis.) on one of its six high-speed extrusion lines and plans the same for the rest, according to H+S project manager Thomas Haab. The printers reportedly can generate "reliably legible typography" on wire/cable and pipe extrusion lines, where speeds can exceed 3280 ft/min, says Christina Leibinger, the machine builder's managing director.

The unit was developed by Leibinger to ensure that its printers did not become a bottleneck in high-speed extrusion systems used in wire/cable and pipe manufacturing. Top-range production systems for coating electrical or fiber-optic wires are operating at increasingly higher speeds. According to Leibinger (***leibinger-group.com***), these speeds threaten to bring traditional printers located downstream to their knees: The manufacturer's name, logo, batch number and length label become distorted if not altogether illegible. If the printer hits its limit for a mere two minutes, more than 6500 ft of expensive cable gets tossed.



H+S plans to install the JET Rapid CIJ inline printer on all six of its high-speed extrusion lines.

H+S's low-frequency technology segment currently runs 18 extrusion lines, according to Haab. "Most of our cable jacketing is made of crosslinked PE. All crosslinked compounds are developed and produced by H+S." The company (***hubersuhner.com***) had previously used gravure wheel printing systems, as other printing units were not fast enough for the speeds desired. Before buying the Leibinger inline CIJ printer, the company evaluated several other systems, including wheel printing and other brands of inkjet printing. "We tested different suppliers' equipment regarding speed, print quality and process safety," explains Haab, who adds that these tests showed only the Leibinger unit could achieve the required speeds.

> ***The new printer can print at a rate "impossible for the human eye to see."***

Other key advantages cited by Haab include eliminating the issue of printing-wheel wear; the ability to change printing text in seconds; printing flexibility, including the ability to print order numbers, production date and special customer requests; and a clean working environment. Moreover, the printer's unique automatic closure system is said to provide exceptional reliability. In this Sealtronic system, the gutter is retracted and the nozzle is closed to create an airtight seal when the printer is not working. This prevents the ink from drying out and blocking the nozzle—eliminating time-consuming cleaning.

Leibinger claims its new CIJ printer can print at a rate "impossible for the human eye to see." A minute spray nozzle in the cylinder-shaped printhead, mounted above the cable, fires 128,000 electrically charged ink drops towards the gutter every second. A high-voltage field between the gutter ends changes the trajectory of individual ink drops. The drops land on the cable as pixels and are dry in less than a second.

According to Leibinger, information such as the manufacturer's name, data-matrix code, and graphics appear on the cable as if painted by an invisible hand. And not just in black, yellow and blue; further developments allow the JET Rapid to now print easily readable white text on black cables through use of specially pigmented inks. PT

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