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Tubing Innovator Doesn't Sweat Hard Stuff

Kent Elastomer Products Innovates in Range of High-Tech Tubing Markets

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An Opportunity by Design

At the very moment that intensifying public pressure pushes the plastics industry to address waste in the environment, the sector is stepping up to reclaim the valuable materials it's created.

Tony Deligio
Editor-in-Chief

"A mistake by design" — that's how Beltrán Orrego sees any plastic waste, particularly if that plastic waste has escaped into the environment. This instinctive reaction to litter is most visceral when it's in nature, where seeing discarded man-made objects, whether it's a water bottle or abandoned car, reflects a jarring human encroachment on the natural world.

Orrego works with Chilean injection molder and recycler Comberplast, which launched its Atando Cabos project to pull waste plastic from the environment and repurpose it into new items. Its primary source of such waste is the salmon-farming detritus in the Patagonia. On vacation in the region years ago, it was one of Comberplast's founders whose encounters with abandoned ropes and nets amongst the grandeur of the fjords and channels became an impetus to do something. In this issue, you can read about Comberplast's latest project partnering with one of the world's largest producers of lithium to create reusable plastic pallets from that recovered fishing waste, as well as the lithium firm's in-house plastic scrap.

The plastics industry perceives the promise and potential of plastic scrap. Source: Getty

For people like Orrego, who work in the plastics industry seeing everyday items fabricated from the highly engineered materials we know discarded as trash does indeed seem like a "mistake." Early in my career, I sat in on a presentation discussing the various breakthroughs achieved in the package design for a "sports drink" bottle. The bottle in question featured a series of raised panels. Each distinct panel and its various facets, which I had thought to simply be decorative flourishes, were in fact the patented outcome of hours of engineering work that enabled the plastic container to withstand the hot-filling process and replace glass, resulting in a package that would dramatically cut the beverage's weight and the CO_2 emissions required to ship it. To this day, when I see a sports drink bottle or any plastic product, I consider the purposeful engineering that went into its design, thinking about the specific material grades and additives it's made from and the specialized machines and molds that created it.

In addition to Comberplast, in this issue you can read about Mexican film extruder Bioflex applying new technology to process postindustrial and postconsumer plastic waste into new films; Nova Chemicals writing about the opportunities to be exploited in mechanical recycling of plastics, including its own new facility for reclaiming postconsumer polyethylene; and the challenges of sourcing reclaimed polypropylene, particularly as some studies point to the contamination of food-contact-intended streams with recycled electronic waste.

This confluence of content is no accident. At this moment in the industry, an overwhelming interest to redirect plastics products in their end of life out of the environment is met by innovative players and technologies specifically targeting that very plastic "waste" as an untapped resource. The old adage holds that one man's trash is another's treasure, and that might be true, but I think we can all also agree that treating treasure as "trash" is surely a mistake. PT

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Recycled Polystyrene Yogurt Cups Come to Fruition

Ineos Styrolution announced the successful completion of a project to incorporate mechanically recycled postconsumer polystyrene into yogurt cups. The Ineos process involves deep NIR sorting, including object recognition, hot washing, melt filtration and pelletizing.

Key in the process is Ineos Styrolution's "super clean process" which has been registered as a novel technology according to the EU regulation 2022/1616. With this process, Ineos Styrolution achieves food contact quality recyclates, which before were only known (in the EU) from PET bottle recyclates.

According to Ineos, the recycled material offers the same physical properties as conventionally produced polystyrene. Intensive quality controls were performed on both the material and the cups. Additionally, detailed analyses are required for the European Food Safety Authority (EFSA) evaluation of the technology.

A first consumer test on the acceptance of the recyclate-containing cup and the cup color was conducted in spring 2024 in collaboration with Unternehmensgruppe Theo Müller, a German dairy manufacturer. Several hundred yogurt cups made from recycled polystyrene were filled and offered to volunteers in an Ineos canteen to evaluate the innovation. According to feedback results, 90% of the testers indicated they would buy the product. Testers also shared feedback that a recycled cup in a color other than today's plain white would be completely acceptable.

"Polystyrene arrived in the champions league of recycled food contact materials. It will enable producers to meet the new requirements of the new EU directive PPWR for packaging and packaging waste," says Dr. Frank Eisenträger, ECO and market development manager at Ineos Styrolution.

The new technology was presented at the Dresden Packaging Conference by Eisenträger along with Lena Lembach, senior packaging development, Unternehmensgruppe Theo Müller.

Increased Bottle Collection Rate in 2023

The National Association for PET Container Resources (NAPCOR) has released its 2023 PET Recycling Report. The U.S. PET bottle collection rate was 33% in 2023, up four percentage points from 2022. The average amount of postconsumer recycled (PCR) PET, also known as recycled PET (rPET), used in U.S. bottles and jars was 16.2% in 2023, up 3 percentage points from 2022. This is the highest level ever and demonstrates increased demand for recycled PET nationwide.

The total pounds of PET bottles available for recycling in the U.S. in 2023 was 5,952 million pounds, down 9.8% from 6,599 million pounds in 2022. Domestic sales of both new (also called virgin) and recycled PET resin to non-food/beverage bottle applications (for example, personal care packaging and household cleaners) were down by significant margins compared to 2022.

"PET plastic bottles play a vital role in a circular economy because they can be designed to be remade and our members are working hard to ensure they get recycled," says Laura Stewart, NAPCOR's executive director. "NAPCOR's 2023 PET Recycling Report shows that while there were fewer PET bottles available to recycle in the U.S., there were still more PET bottles recycled in 2023, resulting in a higher recovery percentage. When manufacturers, consumers, retailers and recyclers work together to ensure PET is selected, collected and recycled, our planet reaps the rewards."

The collection rate of 33% was the highest level in nearly 30 years due to growth in PET plastic bottles collected and fewer bottles available for recycling compared to 2022. The U.S. collected 1,962 million pounds of PET bottles for recycling in 2023, the highest annual weight for U.S. bottle collection recorded, up from 1,911 million pounds in 2022, an increase of 2.7%.

Emirates Biotech Selects Sulzer Technology for Polylactic Acid Production

Emirates Biotech has selected Sulzer as the technology provider for its upcoming polylactic acid (PLA) production plant in the United Arab Emirates. The facility will be constructed in two phases, each with an annual capacity of 80,000 metric tons (88,200 U.S. tons), resulting in a total production capacity of 160,000 metric tons per year. According to Emirates Biotech, this volume of bioplastic material is enough to replace approximately 3.2 billion plastic bottles and reduce CO_2 emissions by over 300,000 metric tons annually.

Emirates Biotech will leverage Sulzer's licensed PLA technology to manage all production steps from a single location, including lactide production, purification and polymerization. The facility will also use a plant-based feedstock to produce high-quality PLA bioplastics at scale.

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Chroma Color Expands Footprint With Acquisition of Spectra Color

Chroma Color Corp., a supplier of specialty color and additive concentrates, announced its recent acquisition of Spectra Color Inc., a custom manufacturer of colorants and precolored resin compounds. Spectra also manufactures a proprietary resin primarily made from linear low-density polyethylene (LLDPE), which is predominantly used in the rotational molding industry.

Located in Corona, California, Spectra is a provider of masterbatch and color-matching services with custom blending capabilities. Founded in 1976, it has supplied the plastic industry with thermoplastic compounds, colorants, additives and value-added resins for over 45 years. Spectra serves diverse end markets, including medical, health care, agriculture and consumer products, among others.

"We are thrilled to join forces with Chroma Color. Chroma's strong market reputation and shared vision for the business make this partnership a perfect fit. By combining our technological expertise, we can deliver a powerful competitive advantage, enhance performance and create even greater value for our customers," says Spectra CEO Bob Shedd.

Chroma Color serves markets that include wire and cable, packaging, health care, pharmaceutical and consumer products.

"Chroma Color is dedicated to driving growth through both organic initiatives and inorganic growth opportunities. The acquisition of Spectra Color underscores our commitment to expanding our geographic reach and enhancing our product offerings to better serve our customers," says Joe Herres, Chroma Color CEO. "The entire team is fully prepared to support Spectra's customers during this transition, and we are confident they will experience significant value from Chroma's extensive capabilities and resources."

Engel Begins Construction of New Automation Factory in Poland

Engel Group subsidiary TMA Automation Sp. z o.o. has begun construction of a new office and production building near the Gdansk Airport in Poland. Engel acquired a majority stake in TMA Automation in 2022 and, in a release, the company says the new building in Gdansk will "intensify the collaboration" between the two entities. TMA Automation remains active in the market as an independent brand, and while its founders Marek Langowski and Piotr Orlikowski will continue to manage the business, Walter Aumayr was named VP for postmerger integration of the Engel Group and managing director at TMA Automation. In this role, Engel says Aumayr will "supplement the local management team and strengthen the connection to the Engel Group."

The new building is part of an expansion strategy for TMA Automation, which includes a doubling of the company's workforce. TMA manufactures customized automation systems for Eastern Europe, specializing in developing and installing customized systems targeting in-mold labeling (IML), side-entry robots, palletizing and stand-alone assembly.

An Engel spokesperson declined to share the size of the new facility or its impact on capacity in Poland but did say that, depending on the course of business, Engel will gradually increase the number of employees (which is currently at 40) as well as the capacity, with the assumption that this expansion will make it possible to eventually double the number of employees and turnover.

Engel notes that its collaboration with TMA in the region began long before the Austrian company acquired a majority stake in 2022. The new building is expected to be completed by autumn 2025. TMA was founded in 2010 in Gdynia, Poland, roughly 15 miles from the Gdansk Airport.

Niigata Machinery Shifts U.S., Canadian Sales and Service to Absolute Haitian

Japanese injection molding machine maker Niigata Machinery Co. Ltd., which was acquired by Haitian International in 2023, is transitioning sales and service of Niigata machines in the U.S. and Canada to Absolute Haitian effective March 1, 2025. Absolute Haitian (which represents Haitian in the U.S. and Canada) is based in Moncks Corner, South Carolina, with offices in Worcester, Massachusetts, and Parma, Ohio. Founded in 2022, Niigata Machinery Co. Ltd. acquired the injection molding business of Niigata Machine Techno Co. Ltd. in 2023, with financial backing from Haitian International. The transition expands Absolute Haitian's product offerings, with the company saying that customers will benefit from a unified supplier by gaining access to a broader range of horizontal machines and vertical machines, and enhanced customer support infrastructure.

This change coincides with the construction of new Niigata production facilities in Momoyama, Japan. Those investments will centralize research, product development, applications, engineering, manufacturing and support with standard Niigata products, including horizontal and vertical electric injection molding machines, to be manufactured at the new factory. Founded in 1895, Niigata expanded from machine tool manufacturing in 1963, when the company partnered with German firm Stube to produce its first injection molding machine. Niigata Machine Techno USA was created in 2017 and, in 2019, it restructured and designated Elk Grove Village, Illinois, as its North American headquarters which, until this announcement, handled injection molding machine sales, service, support, parts and repair throughout the U.S. and Canada.

SACMI's PET Bottle and Labeling Machinery Integrated Into Omnia Techologies

SACMI of Italy sold its Beverage and Labeling business units in May 2024 to Omnia Technologies, another Italian firm that provides automation and bottling technologies for wine, spirits, beverages, dairy and pharmaceuticals. As of September 2024, the former SACMI units became part of ACMI, an unrelated Italian firm acquired around the same time by Omnia Technologies and dedicated to design of complete bottling and packaging lines for food and beverages in PET and glass bottles, metal cans, plastic cups and bag-in-box.

The former SACMI Beverage products are now part of ACMI Blowing and Filling. These include Smartblow two-stage stretch-blow molding machines, filling/capping machines and complete systems for blowing, filling, capping and labeling, as well as Form Fill Seal (FFS). The former SACMI Labeling offerings are now in ACMI Labeling Solutions: medium- and high-speed labelers as well as bag-in-box systems. These two new business units join the original ACMI Bottling and Packaging Systems. Meanwhile, SACMI retains its Compression Blow Forming (CBF) systems for plastic bottles, continuous compression molding (CCM) systems for plastic caps and IPS systems for injection molding PET preforms.

Geon Buys Medical Compounder Foster

GEON Performance Solutions has acquired Foster Corp., a compounder of biomedical polymers used in the high-growth health care and medical device industry.

The move is intended to broaden GEON's portfolio in the medical market, where it currently offers rigid and flexible PVC and TPE compounds as well as contract manufacturing services. Its Clinton, Tennessee, facility is ISO 13485:2016 certified, the medical industry's international standard for the manufacture of medical devices.

Based in Putnam, Connecticut, Foster, which is also ISO 13485:2016 certified, offers formulation, development and production of custom medical compounds, implantable materials, engineered polymers, thermoplastic polyurethane elastomers and polymer enhancements. It also offers a range of services in clean and white room manufacturing facilities.

"This strategic acquisition broadens GEON's portfolio of medical polymer solutions to offer a full spectrum of materials to medical companies," notes GEON CEO Tracy Garrison. "Foster has an impressive 36-year track record of delivering highly innovative, market-leading technologies for lifesaving medical devices. We are privileged to partner with their team to further strengthen and expand this tradition of excellence."

Adds Foster President and CEO Larry Acquarulo, "GEON is the ideal partner to leverage Foster's strengths and augment its capabilities to better serve unique customer needs. We are proud that Foster's commitment to quality and innovation will live on with GEON."

Novel Line Turns Fluff Into Blown Film

Processor Bioflex of Mexico is utilizing Reifenhäuser Blown Film's EVO Fusion technology to integrate postindustrial and postconsumer recycled materials into products.

Jose Lozano, Bioflex general director, and Ulrich Reifenhäuser, Reifenhäuser Group general director. Source: PT

By María Natalia Ortega Leyva
Editorial Director Plastics Technology Mexico

At an open house event held at Bioflex's facilities in Mexico, Reifenhäuser Blown Film showcased for the first time in the Americas one of its latest technological advancements — EVO Fusion. This line aims to reshape the landscape of film processing with more sustainable and efficient production methods.

Reifenhäuser says EVO Fusion technology is set to shift paradigms in the industry. Traditionally, the use of postconsumer recycled materials (PCR) in film production has faced challenges due to quality inconsistencies. PCR quality can vary significantly between batches due to the heterogeneous mix of plastic types and the constant presence of impurities.

Notes Dr. -Ing. Christoph Lettowsky, technical manager of Reifenhäuser's Blown Film Unit: "The first batch may be good, but the second or third might not be." These inconsistencies have historically led to processing difficulties and final products that could not compare to those made from virgin materials.

Michelle Voss Díaz, director of sustainability at Bioflex, explains the benefits obtained since the installation of EVO Fusion Line.

Reifenhäuser's twin-screw technology is said to improve mixing and degassing to remove impurities and unwanted components, thereby enhancing film quality.

However, EVO Fusion addresses these challenges by reducing dependency on material quality. It enables efficient use of PCR — even from low-quality plastics derived from postconsumer waste — integrating them directly into the production process without pelletization. This capability not only broadens the range of applications but also reduces energy costs by up to 40%, significantly enhancing both the economic and environmental appeal of using recycled materials.

In addition, the EVO Fusion system processes postindustrial recycled materials (PIR), enabling the recovery of production floor waste such as barrier films with printing and lamination. These materials can be fed directly into the shredder, cut into small pieces or fluff, and added directly to the EVO Fusion twin-screw extruder.

The ability to add these wastes directly into the extruder without prior pelletization streamlines the process and further reduces the environmental footprint.

By facilitating the use of recycled materials in high-quality film production without traditional cost and energy barriers, these technologies make adopting sustainable practices both feasible and profitable for film manufacturers.

It is also worth noting that as sustainability reshapes market expectations, there is growing acceptance of recycled films. What was once deemed undesirable due to aesthetic considerations is now becoming a hallmark of environmental commitment. Both brands and consumers increasingly value the "recycled look," which visibly communicates a commitment to environmental stewardship.

According to Ulrich Reifenhäuser, director of Reifenhäuser Group, the plastics and recycling industries will soon become one interconnected sector. The market urgently needs to facilitate the integration of recycled materials across all processes and markets. EVO Fusion stands out as a technology that aims precisely in this direction.

EVO Fusion system processes postindustrial recycled materials (PIR), enabling the recovery of production floor waste such as barrier films with printing and lamination.

BIOFLEX IN MEXICO: A FIRST FOR THE AMERICAS

Bioflex, a flexible packaging manufacturer based in Leon, Guanajuato, is a pioneer in implementing this technology in the Americas. During the Open House, the company demonstrated the EVO Fusion extrusion technology for processing PIR directly in fluff form, without pelletization. Before having the EVO Fusion, these materials were used to manufacture pallets, trash bins and plastic containers. Now, this extrusion and conversion process waste is used to produce high-quality polyethylene (PE) film with recycled content.

"This technology not only symbolizes innovation for Bioflex but also sets the course for a more responsible and conscious industry model."

With this technology developed by Reifenhäuser, Bioflex positions itself as a trailblazer in the Americas by directly integrating recycled material into film production for various industries and products. This process not only redefines the use of recycled resources but also drives a shift toward a circular economy, promoting the reintegration of materials into their original value chain.

Michelle Voss Díaz, sustainability director at Bioflex, described the transition to this technology as a journey of discovery and continuous learning. "Introducing an innovative approach to the use of recycled materials required operational adjustments and a mindset shift. However, thanks to initial trials with customers and technical support from Reifenhäuser Blown Film, the transition has been smooth and promising," she notes. This adaptation was not only technical but also cultural within the company, underscoring a genuine commitment to sustainability at all operational levels.

Furthermore, the market's reception of products manufactured with EVO Fusion has been significantly positive. "Customers who have tested films produced with EVO Fusion not only praise the technical quality of the product but also value the added benefit of incorporating recycled materials into its composition," Voss Díaz says. "This balance between functionality and sustainability has generated trust and reaffirms Bioflex's vision that it is possible to offer responsible solutions without compromising performance. This initial success serves as critical validation for Bioflex and inspires continued progress toward a circular economy." PT

Making Safety a Priority in Recycled Plastic for Personal Care and Food-Contact Products

Proper quality controls and feedstream selection can produce recycled materials for any application.

By Matt Stonecash
Associate Editor

If more plastics processors are to incorporate recycled materials into their products, in response to customer demand or regulation, investment in quality systems will be necessary across the supply chain. Recyclers and converters of recycled materials need robust material traceability systems to ensure the reclaimed feedstock is appropriate for the desired application. This is especially true for products that are used in food or personal care applications.

A paper published in Chemosphere (Liu et al. 2024) drew wide media coverage of evidence that flame retardants — including brominated flame retardants (BFRs) — are making their way into black plastic products, even those used in food-contact applications. BFRs are also used in electronics applications such as enclosures and cabling.

Brominated flame retardants were found in black plastic cookware, according to a 2024 study (Liu et al.), a 2018 study (Kuang et al.) and a 2013 study (Samsonek & Puype). Source: Getty Images.

While an arithmetic error in the paper has drawn criticism, the presence of flame retardants in cookware has not been a subject of dispute and is not unique to this study.

Various items were sampled, including kitchen utensils and food serviceware. Levels of bromine ranged widely, up to tens of thousands of parts per million (ppm). Further testing identified 11 flame-retardant compounds including decabromodiphenyl ether (decaBDE) and tetrabromobisphenol A (TBBPA).

Research studies show BFRs have health effects on a wide variety of systems in humans and animals. These materials are not authorized for food-contact use, according to the FDA. They can migrate into food during use, becoming "indirect food additives." The regulation of indirect food additives is covered by 21 CFR Part 177, which lists the appropriate polymers for food contact use and associated additives.

The FDA has acted in the past to prevent such items from entering the U.S. market. In October 2024, the FDA published an Import Alert red listing for a variety of food-contact items, including three products containing BFRs.

ENVIRONMENTAL STATUS

BFRs present an environmental challenge because of their toxicity, persistence and bioaccumulation. DecaBDE and hexabromocyclododecane (HBCD) have been targeted for elimination by the Stockholm Convention, to which 186 nations are party. In the U.S. (not among these), the manufacture and processing of decaBDE is prohibited (40.CFR.751.405), with an exception for recycling of decaBDE-containing recycled plastics. Concentrations found in the Liu study are up to 11,900 mg/kg — which is 10 times what would be allowed in a new product if it was not recycled (0.1% by weight is the unintentional limit).

The EPA has established an oral reference dose for decaBDE of 7 µg/kg/day. As originally published, the Liu paper mistakenly said this would correspond to 42 µg/day for a 60 kg individual rather than 420 µg/day. The error could lead to an inflated perception of risk relative to the predicted doses up to 34.7 µg/day. The authors have since published an erratum. The oral reference dose estimates the amount, within an order of magnitude, that could be ingested without ill effects. It does not establish the level that can be present in food products, which falls under food additive regulations.

FDA CONCERNS ABOUT BFRS

A previous paper (Kuang et al. 2018) used simulated cooking conditions to show that flame retardants readily transfer from kitchen utensils to cooking oil. Liu's paper uses the resulting migration rate, along with its own concentration data, to calculate estimated doses.

Based on the material types and flame retardants detected, the study's authors suggest — as have the authors of similar previous studies — the source of the material may be recycled electronics. According to an FDA spokesperson, recycled electronics are not deemed to be a safe source of recycled material for food-contact plastic products. The FDA's safety concerns with recycled plastic materials are that contaminants from recycled material may end up in the

final product; that recycled material not regulated for food contact use may be incorporated; or that adjuvants in recycled plastic may not comply with regulations for food contact use.

It is the responsibility of manufacturers to ensure that any recycled materials meet the same safety regulations that govern virgin raw materials. However, the FDA does offer detailed guidance on practices to prevent the introduction of contaminants in the production process.

EXISTING ROAD MAP TO SAFE RECYCLED MATERIALS

Recyclers can submit a prenotification consultation (PNC) notifying the agency of its intent to use a particular stream of postconsumer materials for certain conditions of use. The FDA will evaluate the quality controls described, and often request additional information. If satisfied, the FDA will issue a letter of "no objection" (NOL) if it agrees that the quality controls in place are expected to produce a safe product.

Black polypropylene is not rare in the marketplace, matching the safety requirements of the feedstream and application is key. Source: Matt Stonecash.

Obtaining an NOL signals to converters of recycled plastic that the supplier has sufficient controls in place. It is up to the recycler to maintain these practices, and up to the converter to audit the supplier and confirm these practices are being actively followed.

"The industry really polices itself," says Kevin Cronin, VP of sustainability and R&D at Ultra-Poly, a large recycler of polypropylene that has successfully obtained NOLs. Ultra-Poly and other recyclers that offer "FDA grade" materials have procedures for physically isolating food-grade from non-FDA grade materials. Some Ultra-Poly customers buy only food-contact materials (even if some of the material only goes into applications where it is unnecessary) in the interest of avoiding even the possibility of cross contamination.

According to Cronin, audits can be extensive. "Frequently it takes a full day. They want to see the paper trail, they want to see the chain of custody. They want to see that, once the material gets here, it can't get co-mingled with a non-FDA grade material, for instance — all the steps that are part of our Good Manufacturing Process (GMP) — and they want to see that it is actually being executed," Cronin says.

The NOL process does not apply to postindustrial recycling (although the FDA does offer guidance in this area as well). However, the material streams do not necessarily come from curbside pickup either. In Ultra-Poly's case, the company partnered with a major retailer to recycle polypropylene (PP) used to make coat hangers. In this case, the NOL states that Ultra-Poly has demonstrated that the material is homopolymer PP without additives that would negate its safety.

The NOL specifies conditions of use, A through J, for which the quality controls are deemed to be sufficient. Ultra-Poly's aforementioned PP is used in a cosmetic product at room temperature, so it has conditions of use E, F and G, which is appropriate because there is no thermal treatment in the container. More stringent requirements are required for applications that contact food under conditions that involve sterilizing at high temperature (condition of use "A"), for example, or cooking (condition of use "J").

The FDA also provides a chemistry guide on using recycled materials in food packaging, with recommendations for postindustrial, postconsumer and chemical recyclers regarding where and how these materials could become compromised and actions that should be taken to mitigate. These include testing procedures to confirm the recycling process is capable of removing harmful contaminants, the results of which would accompany a successful PNC. The guide states that a dietary intake of 1.5 µg/day of contaminant would generally be considered of negligible risk.

Mechanical recycling of PP produces a dark gray when the feedstock has mixed colors. Making a black would be easier than making a clear pellet or matching a bright color.

The NOL process has not proven to be an insurmountable hurdle to those companies that have pursued it. Since 1990, the FDA has issued 361 NOLs, 41 of them in 2024 alone.

A popular brand of plastic utensils, OXO, was contacted for a consumer brand perspective on sourcing and tracing recycled materials, but has not responded at the time of this writing.

Guidance exists for converters and brands that seek to incorporate recycled materials in their products and appropriate recycled material is available, but the responsibility remains with individual companies and their customers to strive for and demand the highest safety standards. PT

PTXPO Broadens Educational Opportunities

Beyond gleaning contacts and info by walking its bustling aisles, the third edition of the Plastics Technology Expo (PTXPO) will present attendees the opportunity to gather more than information on the latest technologies, they can also bring back knowledge.

By Tony Deligio
Editor-in-Chief

Educational opportunities will abound at next month's Plastics Technology Expo (PTXPO) on March 18-20 at the Donald E. Stephens Convention Center, in Rosemont, Illinois. Beyond simply walking the show, attendees will have the opportunity to learn about the latest technologies and trends in three additional ways — Tech Talks, In-Booth Demos and the new Discovery Workshops.

TALKING TECHNOLOGY

During the first two days of PTXPO, multiple companies will present from the Tech Talk Theater located on the show floor. On Tuesday, March 18, two presentations will address different topics relating to material handling. Up first, AEC will discuss blending processes and how to use real-time data to find and address inefficiencies. Next, size reduction equipment supplier Cumberland will provide information on how injection molders can establish an in-house recycling operation for internal scrap. Topics include properly sizing a granulator to support mechanical recycling and then optimizing that process once the granulator is installed.

PTXPO (March 18-20 at the Donald E. Stephens Convention Center in Rosemont, Illinois) will once again feature in-booth demonstrations of technology. Source: *Plastics Technology*

On Wednesday, March 19, attendees can learn about how virtual reality (VR) can be used to transform training and education with an immersive experience for active learning and problem-solving via VR simulations of mold design and production. Kruse Analysis says this VR technology directly targets younger, digitally-native engineers. Also on Wednesday, Bales Metal Surface Solutions will tackle how plating technologies can be applied to enhance an injection mold's preventive maintenance program. Attendees will learn how hard chrome or nickel plating can minimize friction, corrosion and abrasion, particularly for molds enduring high-temperature and high-pressure cycles.

LIVE DEMONSTRATIONS

Shifting from the Tech Talk Theater to select exhibitor booths, PTXPO will once again feature In-Booth Demos of technology. Led by subject matter experts, these demos provide a live demonstration of new technologies being highlighted by PTXPO exhibitors. The demonstrations kick off on Tuesday, March 18, with Conair discussing how AI is being applied in resin conveying and drying via its patented Conveying with Optimizer material handling system and ResinWorks with Optimizer central drying system. Described by Conair as "cruise control" for a process, the Optimizer technology will be highlighted by Conair's Justin Carter and Chad Stover.

Also on Tuesday, Absolute Haitian's Sherman McGinnis will talk attendees through all the latest highlights and advances in Haitian's new Generation 5 injection molding machines. Among those highlights are upgraded energy efficiency and intelligence, including integrated adaptive control technology, as well as OPC/UA control features enabling integration of auxiliaries and production moni-

toring. Finally on Tuesday, Torsten Kruse of Kruse Analysis will have a demonstration of the company's Molding Expert Virtual Reality (VR) immersive educational tool for simulating mold design and manufacturing.

On Wednesday, March 19, Engel's Markus Lettau will highlight a pallet/grid test part that is specially designed to showcase structural foaming capabilities and weight reduction technologies. A 310-ton, all-electric e-mac slim edition molding machine will be showcased utilizing partner Moxietec's proprietary process.

Joseph Dobek of AHP CNC Solutions will provide a demonstration of that company's cost-efficient, high-technology CNC machine tools. Part of the Absolute Group of Companies, AHP CNC Solutions is offering North American manufacturers a new option in metal cutting.

Also on Wednesday, Wittmann's Jonathan Fowler will demonstrate that company's Material Source License. Used for material verification and lot tracing, the technology is built around a barcode scanner that can be used to verify the correct material is being placed into the correct source. Moving beyond the manifold, Material Source License seeks to prevent the wrong material from being placed into the incorrect source, whether it's a gaylord, surge bin, drying hopper, silo or other.

Wrapping up on Wednesday, LS Mtron's John Wiley will demonstrate the injection molding machine supplier's Smart Solution 4.0, including its Smart Service portal. This portal's secure dashboard enables users to monitor machine performance, check service status and request maintenance. Conditions are tracked with four status levels, and users can use the portal to order parts, view schematics and monitor order status.

IN-DEPTH EDUCATIONAL OPPORTUNITY

Starting on Monday, March 17, before the show and then running twice daily on Tuesday and Wednesday, are the all-new Discovery Workshops. These educational presentations are grouped by five different hot-button topics for injection molders, featuring subject matter experts as presenters and the opportunity for attendee engagement with panel discussions. The overarching topics for the five workshops include Recruiting, Hiring and Retaining Skilled Employees; Robotic Programming and Project Selection; Managing Regrind; Molding Machine Maintenance; and Injection Molding Bioplastics.

In addition to speakers from leading injection molders and moldmakers like Plastikos, Hoffer Plastics, Westminster Tool and IPL Plastics, these workshops will be led by technical experts from top industry equipment and service suppliers, as well as academia.

INJECTION MOLDING

PART 2

Bulk, Solid and Melt Density: How To Calculate These Values and Why They Matter

Understanding and calculating solid density and melt density will help molders with everything from material and machine selection to determining piece part costs.

By Suhas Kulkarni

In part one, the importance of understanding a material's bulk density was discussed. In part two, we'll address two other densities that are equally important to injection molders: solid density (sometimes simply referred to as density) and melt density. Solid density is the most commonly used number by designers and processors. It is defined as the weight per unit volume for a given material. For example, if you molded a 1-cm cube using a generic unfilled polypropylene (PP), then the weight of the cube will be the density of the PP. The volume of the cube is 1 cubic centimeter (cm^3), and if the weight is 0.91 gram, then the weight per unit volume (or density) will be 0.91 g/cm^3. The figure 0.91 is in fact the widely used density for PP.

Because specific gravity is sometimes confused with density, we will have a quick explanation here. The density of water is 1 g/cm^3, meaning if we could mold a cube of water with dimensions of $1 \times 1 \times 1$ cm, it would weigh 1.00 gram. Specific gravity is defined as the ratio of the density of the material under consideration compared to the density of water. Considering PP from above, its specific gravity would be 0.91/1.00 which equals 0.91 (because this is a ratio there are no units). Numerically, the numbers for density as well as specific gravity are the same and that's the reason why the two terms are confusing and often used interchangeably. However, each has its own place and their significance must be understood. Material datasheets provided by resin manufacturers are the source of the solid density or specific gravity values.

Scan for more expert advice in injection molding.

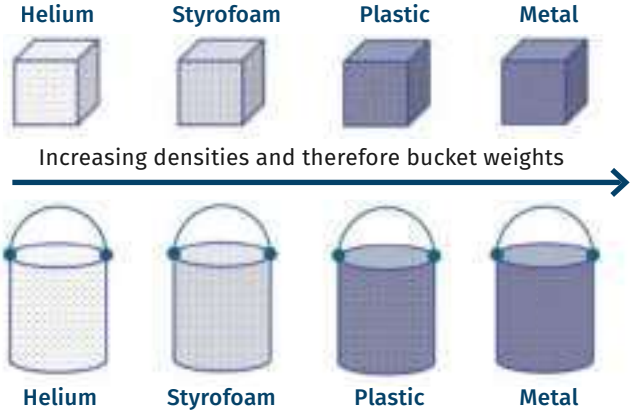
WHY PART WEIGHT MATTERS

The weight of a molded part is required for two main reasons. First, to determine the amount of raw material that will be needed to mold a given quantity of parts; and second, to find a suitable machine to mold the parts. When a designer first designs a part, it is only a CAD model — there are no physical components. To determine what the part will weigh, the designer will need to multiply the volume of the part with the density of the material from which it will be molded. The CAD model will provide the volume of the part.

If the material changes, the density will change and therefore the part weight changes. Production molds can have multiple cavities with multiple cold runners. In this case, the weight of the runners also needs to be estimated using the same formula and then added to the part weight. This combined weight of the parts and runners is called the shot weight. To calculate the amount of material required for production, the shot weight is multiplied by the number of required cycles. The cost of the material is then calculated based on the amount of required material.

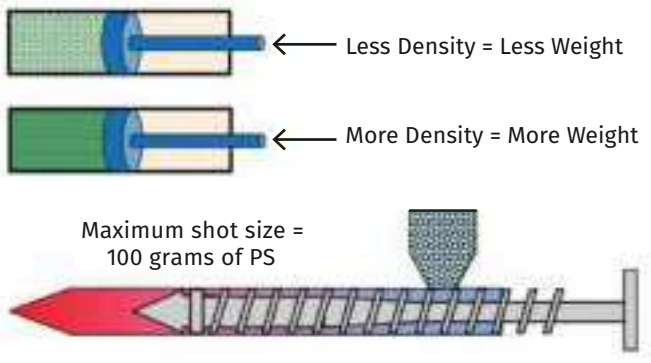
To establish a robust process, it is important to have a correctly sized barrel. The machine manufacturer usually publishes the maximum machine barrel capacity in terms of weight. The ratio of the weight of the injected shot to the barrel capacity should not

FIG 1



The buckets hold the same volume but weigh differently because of different densities.

FIG 2



Material	Density (g/cm³)	Max Shot Capacity (grams)
PS*	1.06	100
Nylon 6	1.15	108
Acetal	1.42	134
30% glass-filled PBT	1.53	144
LDPE	0.92	87
PP	0.90	85

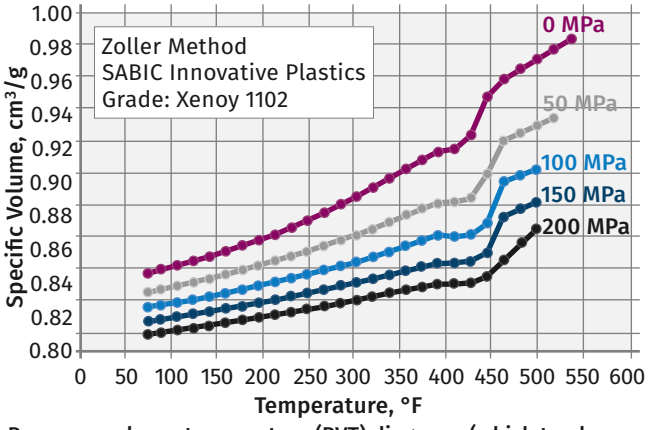
*Published value by the machine manufacturer.

Because of differences in their densities, different materials will have a different maximum shot capacity in the same barrel.

be too small or too big as this leads to inconsistency in product quality and process control. The preferred ratio of the shot weight to the max barrel capacity is between 20% and 80%. For example, if the maximum barrel capacity is 100 grams, then the shot weight should not be less than 20 grams or more than 80 grams. (There can be some exceptions to these percentages, but that discussion is beyond the scope of this article).

If the published barrel capacity is given in weight, then that weight is always given in terms of the weight of polystyrene (PS). For example, if the published weight is 100 grams, that means the maximum amount of PS the barrel will hold is 100 grams or, in other words, the largest shot that can be molded will be 100 grams of PS. This means that the maximum volume of the barrel, which is in the form of a cylinder, is fixed and holds 100 grams of PS.

FIG 3 **Plastic Volume vs. Temperature — PVT Diagram**



Pressure-volume-temperature (PVT) diagrams (which track changes in a material's volume as pressure and temperature are altered) are often used to determine a material's melt density.

The density of PS is 1.06 g/cm³. If we were to replace the PS with a material with a higher density, then the total shot weight will increase. For example, if we replace the PS with a glass-filled polyester (PBT) that has a density of 1.53, then the barrel will now hold 144 grams of the PBT. The barrel's volume stays the same, but because the density of the material is higher, the total weight is also higher. Figure 1 illustrates this concept using a bucket filled with different materials. Figure 2 shows the concept with the injection molding barrel and the calculated values for different materials. To convert the barrel capacity from PS to the material being molded, use the following formula:

$$\text{New Shot Capacity} = \frac{\text{Shot Capacity in PS}}{1.06} \times \text{Density of the Material Being Molded}$$

The percentage usage of the barrel should be based on the barrel capacity and consider the material that is being molded. Knowledge about and the value of the density is therefore critical for such calculations.

It is not uncommon that the material being used to mold a product must change. This could be the result of the first-choice material not performing as intended out in the field, forcing a replacement with a material that meets the customer's requirements. A part that is breaking may need a glass-reinforced resin, for instance. In a recent project I worked on, a material had to be replaced because the original resin was leaving a residue in the mold cavities and causing cosmetic defects. Material replacement could also be due to financial considerations, such as if a material supplier increases the resin's cost and a cheaper replacement must be found.

While searching for alternative resins, it is critical that manufacturers don't focus only on the resin's price per pound. A cheaper resin could have a higher density, which requires more resin for the job and drives up the cost per part. Calculate the weight of the shot based on the density of the material being considered and then calculate the impact on the cost. The new and old costs should be compared before any decision is made.

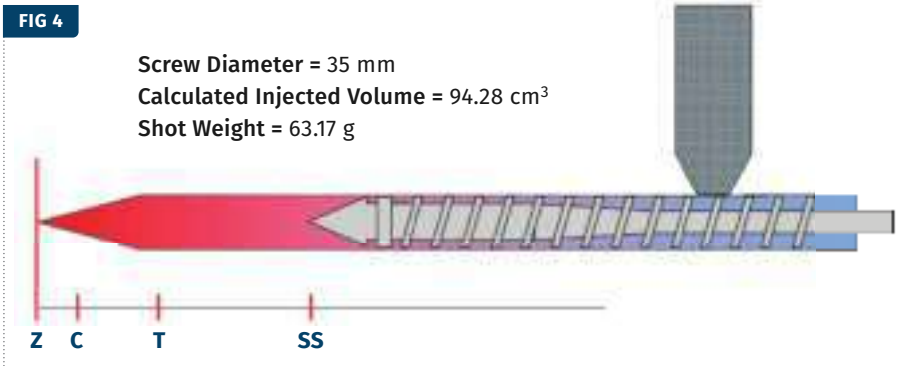
CALCULATING MELT DENSITY

The third type of density is called the melt density and it is a critical specification processors need to know. When the plastic is in the solid form, its density is known as the solid density or simply density. When the processor feeds the resin into the molding machine, the plastic melts and the molecules move away from each other, thereby lowering the material's density. The density of the molten material is known as the melt density. Pressure volume-temperature (PVT) diagrams, such as the one shown in Figure 3, are often used to determine a material's melt density.

Melt density is mainly used to calculate the actual maximum shot capacity of the machine rather than rely upon the machine manufacturer's number. Why? It's not that manufacturers provide incorrect numbers, but rather that the number they provide is just a close estimate. As seen from the PVT diagram, melt density is a function of temperature and pressure. Considering the molten plastic in the barrel, the temperature is the product of the barrel settings and shear from the screw rotation speed, while the pressure results from the back pressure during the screw recovery process.

In recent years, in addition to the maximum shot weight in terms of PS, machine manufacturers have started publishing the

FIG 4



The commonly used factor of 0.70 to 0.80 is a good estimate to determine melt density, but a more precise figure can be arrived at.

maximum machine capacities in terms of volume, because volume is independent of the material or its density. It is now up to the processor to figure out the maximum shot weight based on the material being molded. In this case, molders must use the melt density to accurately calculate the shot capacity. Using solid density will give a number that will be higher and therefore incorrect. Processors tend to multiply the solid density figure by a factor of between 0.70 and 0.80 to estimate the melt density.

Set aside all this to say, calculating melt density is surprisingly easy! There is a much easier method to obtain the exact number. The only requirement here is that the molder should have molded the material before. Even a similar grade of the material is good enough for our calculation.

Given that the formula for calculating weight is Weight = Volume × Density, the calculation for obtaining density is: Density = Weight/Volume. In a known molding process, the weight will be equal to the shot weight, which again, is the weight of all the parts and the runners. The volume will be the total volume displaced by the screw, which will be from the shot size to the cushion value (see Figure 4 for an example). Here, the melt temperature is 380°F and the back pressure is 500 psi, with a screw diameter of 35 mm. The set shot size is 104.6 mm and the cushion value is 6.6 mm. By using the formula for determining the volume of a cylinder — 0.785 × D × D × L (where D is the diameter of the screw and L is the total distance traveled) — we calculate the volume injected to be 94.28 cm^3 (note the conversion of mm to cm.) This volume molded a shot weight of 63.17 grams. Using the formula for density, the calculated melt density is 0.67 g/cm^3.

The melt density here is 70% of the solid density or at a factor of 0.70 of the value of 0.95 g/cm^3. It is important to remember that this was at a melt temperature of 380°F and a back pressure of 500 psi. The commonly used factor of 0.70 to 0.80 is a good estimate, but performing this calculation gives us much more accurate values.

This two-part article covered the basics of the three types of densities in injection molding. It is always a good practice to document the three types of densities for all the materials used in a molding operation. For melt density, molders could even go one step further and generate an empirical formula or a graph to calculate the value based on melt temperature and back pressure. PT

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EXTRUSION

Optimizing Melt-Fed Single-Screw Extruders on Compounding Lines

The main problem with melt-fed extruders that are starve-fed is setting the depth of the metering channel. In this scenario, we describe how this problem was solved.

By Mark A. Spalding

Some compounding lines feature a twin-screw extruder or continuous mixer for the compounding operation followed by a melt-fed, single-screw extruder for material pressurization for pelletization. A typical configuration is provided by the schematic in Figure 1.

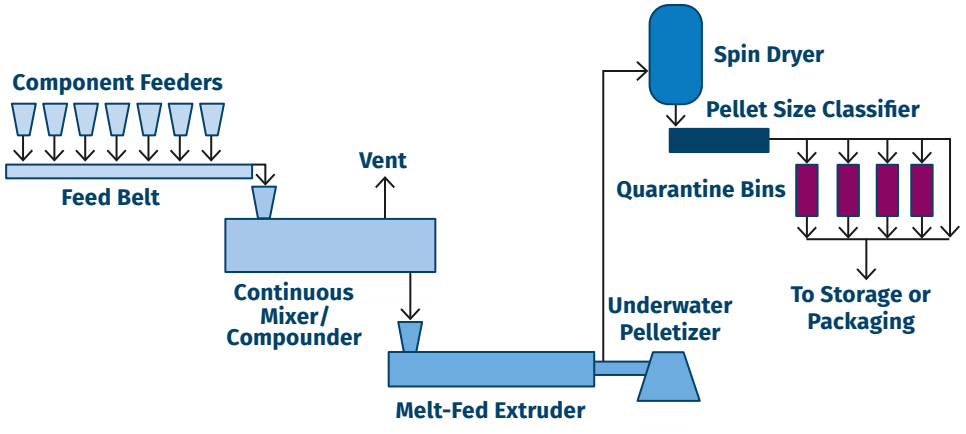
Here, the individual feedstocks are metered to a conveyor belt and then fed to a twin-screw extruder or a continuous mixer for compounding. The rate of the process is controlled by the feeders, while the maximum rate is controlled by the compounder. That is, the rate is typically increased until the compounder is operating near the maximum torque limit.

Next, the discharge from the compounder is fed to the feed port of a single-screw extruder via gravity. The single-screw extruder is operated starve-fed such that compounded material never accumulates in the feed hopper. The pressure increases down the length of the screw, creating enough pressure to operate the pelletizer. The single-screw extruder should never be the rate-controlling segment of the line.

The single-screw extruder has zero pressure at the feed port and a relatively high discharge pressure to run the pelletizer. Thus, the extruder develops a positive axial pressure gradient. This gradient will reduce the specific rate of the process. The specific rate is simply the rate divided by the screw speed — for example, lbs/(hr rpm). The ability of the extruder to generate pressure while maintaining the rate depends mainly on the metering channel depth, the pressure gradient and the viscosity of the resin.

The main problem with melt-fed extruders that are starve-fed is setting the depth of the metering channel. A compounding line with a 15-inch-diameter pressurizing, single-screw extruder will be described here. This extruder had a screw with a metering channel that was 1.73-inches deep. The channel was too deep to pump and pressurize the resin for pelletization.

FIG 1 Typical Compounding Line with Melt-Fed Single

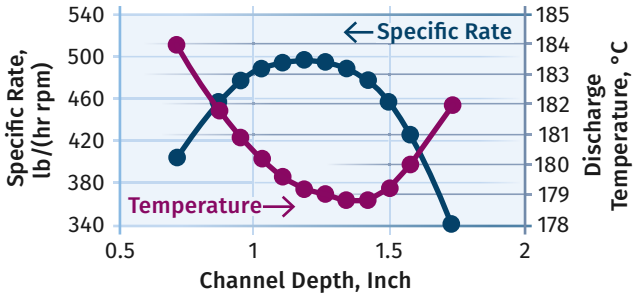


Schematic of a compounding line using a continuous mixer for compounding and a melt-fed, single-screw extruder for pressurization for the pelletizer. Source (all images): Mark Spalding

For this screw, the extruder was only capable of operating at 3,280 lbs/hr at a screw speed of 15 rpm for a specific rate of 219 lbs/(hr rpm). The low specific rate caused the discharge temperature to be too high, causing a flame-retardant chemical additive to degrade. The maximum acceptable discharge temperature for this resin and flame-retardant chemical is about 180°C.

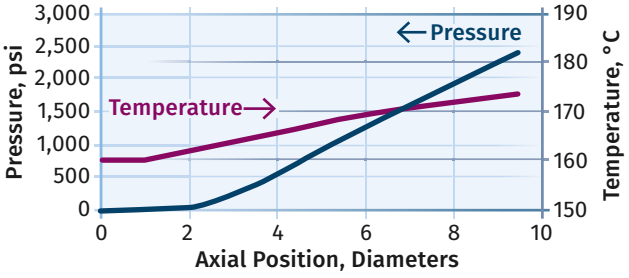
The problem is shown in Figure 2. For metering channel depths between 0.7 and 1 inch, the specific rate increases nearly linearly with increasing channel depth. This is because the specific rotational rate increases linearly with channel depth. The specific rotational rate is the specific rate of the screw due just to the rotation of the screw. That is, there is no

FIG 2 **Metering Channel Depth Influence on Specific Rate, Discharge Temperature**



Specific rate and discharge temperature as a function of metering channel depth for a compounded PE.

FIG 3 **Performance of Optimized Screw with Shallower Metering Channel**



Simulated axial pressure and temperature for the new screw with a channel depth of 1.18 inch. The rate was 8,500 lbs/hr at a screw speed of 15.5 rpm for a specific rate of 548 lbs/(hr rpm).

imposed pressure gradient. The specific rotational rate is known historically as the specific drag rate.

As previously presented, the screw channels have an imposed positive axial pressure gradient. This is because the material entering the feed channel is at zero pressure and the discharge pressure is relatively high due to the requirements of the pelletizer. This pressure gradient decreases the specific rate of the extruder. Moreover, the specific rate decreases to the cube of the metering channel depth. That is why the specific rate has a maximum at a channel depth of about 1.18 inches.

At deeper channel depths, the specific rate decreases at a high rate with increasing channel depth due to the cube functionality of the channel depth. Figure 2 was created using numerical simulation at a rate of 8,500 lbs/hr and a discharge pressure of 3,000 psi for a polyethylene (PE) compounded with a flame-retardant chemical additive.

The discharge temperature of the material is also provided in Figure 2. Here, the temperature had a minimum value of 179°C near a metering channel depth of 1.30 inches. Recall that the maximum specific rate occurs at a channel depth near 1.18 inches. Discharge temperatures typically respond to the specific rate. That is, as specific rate increases, the discharge temperature decreases. At the very deep and very shallow ends of Figure 2, the discharge temperatures were higher at 184°C and 182°C, respectively. At 182°C, some of the flame-retardant chemical was degrading.

Next, a new screw was built that had a shallower metering channel at the optimal depth of 1.18 inches. A simulation of the screw design providing the axial pressure and temperature profiles is shown in Figure 3. The simulation indicates the new screw should be able to pump 8,500 lbs/hr at a screw speed of 15.5 rpm for a specific rate of 548 lbs/(hr rpm). This rate is more than 2.5 times the rate of the original screw.

As shown by Figure 3, the pressure was zero at the feed opening of the screw and the discharge pressure was 2,400 psi, creating the positive axial pressure gradient. As previously stated, this positive pressure gradient along with the channel depth sets the specific rate for this resin. The discharge temperature was simulated at 174°C, a temperature low enough to prevent the flame-retardant chemical from degrading.

Melt-fed extruders used for pelletization should never be the rate-limiting step for a process. Instead, the torque on the rotors of the compounding process should be the rate-limiting step. The melt-fed, single-screw extruder example presented here was the rate-limiting step because the discharge temperature had to be less than 180°C. At higher temperatures, the flame-retardant chemical started to degrade. The optimal channel depth is typical where the specific rate is the highest. Most screw designers understand how to design for this optimal metering channel depth.

The lead length of the screw can be increased slightly to provide a higher specific rate without making the metering channel depth too deep and sensitive to the positive axial pressure gradient. For example, the lead length was equal to the diameter for the original 15-inch-diameter screw, and it was increased to 1.2 times the diameter for the optimized screw. This lead length increase provided an 18% increase in the specific rotation rate.

Moreover, the metering channel depth for optimized channels will typically be between 6 and 8% of the diameter, depending on the viscosity of the resin, the axial length of the metering channel and the discharge pressure. For example, the channel depth of the original screw was 11.8% of the diameter while the optimized screw has a depth of 7.8% of the diameter.

The optimized screw presented here requires additional torque from the motor. If the process cannot supply additional torque, the optimization cannot be performed. Most screw designers understand this problem and routinely check torque requirements. PT

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MATERIALS

Polymer Showdown — PC/ABS vs. PC/PBT — May the Best Material Win

First in a series, experts from plastics engineering consultancy The Madison Group will pit leading thermoplastics against each other to see how they differ in processing characteristics, chemical resistance, thermal and mechanical performance, and more.

By Jack DeSousa

By Richie Anfinsen

Welcome to the ultimate showdown in the world of polymers. In one corner, we have the versatile and tough PC/ABS blend, while in the other, the chemically resistant and durable PC/PBT blend. Both contenders have unique properties and applications, making them popular choices in various industries, but which one will emerge as the champion in this head-to-head battle? Join us as we delve into the strengths and weaknesses of each, comparing their chemical structures, various properties and processing characteristics.

ROUND 1: CHEMICAL STRUCTURE

PC/ABS is a blend or alloy of polycarbonate (PC) and poly(acrylonitrile butadiene styrene) (ABS). PC is known for its high impact strength, stiffness and heat resistance, while ABS features good dimensional stability, low warpage and excellent processing properties. The combination of these polymers results in a material that balances the mechanical performance of PC with the processability and low-temperature performance of ABS. The fact that ABS is a terpolymer with three different functionalities enables further customization of its properties. Acrylonitrile promotes heat and chemical resistance; butadiene contributes to impact strength and low-temperature property retention; and finally styrene adds surface finish and moldability.

PC/PBT, meanwhile, is an immiscible physical blend of polycarbonate (PC) and polybutylene terephthalate (PBT). The PC here is the same polycarbonate as in PC/ABS, while PBT is a semicrystalline polymer, which provides great chemical resistance and strong tensile strength, as well as high UV, weather, wear and electrical resistance. The blend of PC and PBT results in a material that offers a good balance of impact strength, dimensional stability and chemical resistance.

ROUND 2: THERMAL PROPERTIES

PC/ABS and PC/PBT exhibit distinct thermal behaviors due to the differences in their components (Figure 1). The higher glass transition temperature (Tg) of PC/ABS is influenced by the PC component, which has a Tg of around 150°C. The addition of ABS can slightly lower the overall Tg of the blend, whether miscible or immiscible, as shown in Figure 1. PC/PBT, on the other hand, has a lower Tg due to the presence of PBT, which has a Tg around 60°C. Because PBT is immiscible with PC, the Tg of the material remains fixed at 60°C.

Because PC and PBT are condensation polymers, both are susceptible to hydrolysis during molding if proper drying procedures aren't followed.

The higher Tg of PC/ABS compared to PC/PBT would also mean better retention of mechanical properties up to the glass transition temperature(s) of the PC/ABS material. This is illustrated in Figure 2 where the comparison of the dynamic mechanical analysis (DMA) thermograms of PC/ABS and PC/PBT demonstrates how the storage modulus of PC/PBT drops lower than that of PC/ABS through its Tg of about 50°C.

It should be noted that the usable temperature of PC/PBT — or any plastic for that matter — can be increased with the addition of reinforcements such as glass fibers. As shown in Figure 3, the storage modulus of PC/PBT with 11% glass fiber content is very similar to that of virgin PC/ABS at 100°C as the glass fibers increase stiffness in the material.

ROUND 3: MECHANICAL PROPERTIES

Both PC/ABS and PC/PBT offer a good balance of stiffness and tensile strength but with some notable differences (Table 1). PC and ABS offer excellent impact properties across a wide temperature range. The butadiene component in ABS specifically increases its

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low-temperature impact resistance. PBT, on the other hand, lacks inherent impact strength and relies on PC to carry the impact properties, but without butadiene there is poor subambient impact strength. Due to the inherent wear resistance of both PC and PBT, PC/PBT blends offer superior wear properties compared to PC/ABS blends — although specific wear conditions for an application could depend on multiple factors and should be thoroughly tested.

TABLE 1 Mechanical Property Comparison

Typical Properties	PC/ABS	PC/PBT
Modulus (psi)	269,000-443,000	246,000-582,000
Tensile Strength (psi)	6,840-9,710	6,160-9,430
Elongation at Break (%)	1.4-100	1.5-150
Notched Izod at -22°F (ft-lb/in)	9.0	2.9
Notched Izod at 73°F (ft-lb/in)	11	10
Taber Abrasion (mg/1,000 cycles)	54-82	30-33

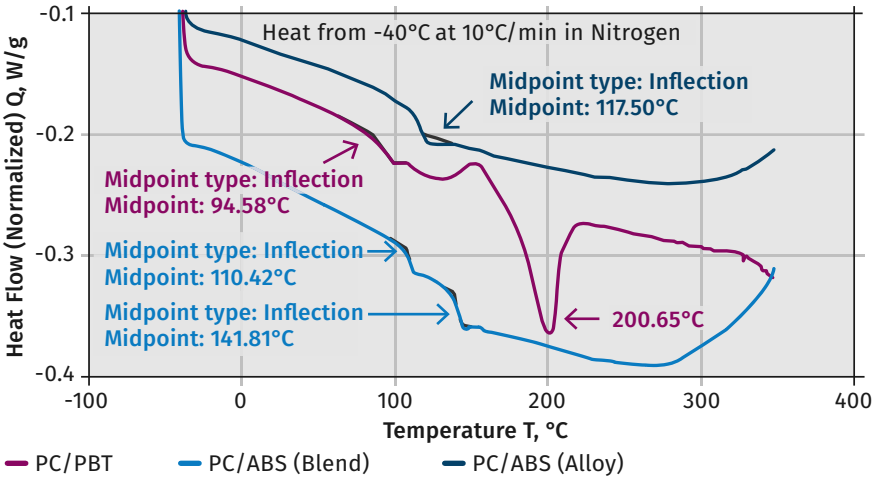
ROUND 4: CHEMICAL RESISTANCE

The exact chemical resistance of the compounds is dependent on the ratio of the components. In general, PC/PBT exhibits better chemical resistance compared to PC/ABS due to the semicrystalline structure of PBT. The PBT component provides excellent resistance to a wider range of chemicals, including solvents, alcohols and oils (Table 2).

ROUND 5: ENVIRONMENTAL RESISTANCE

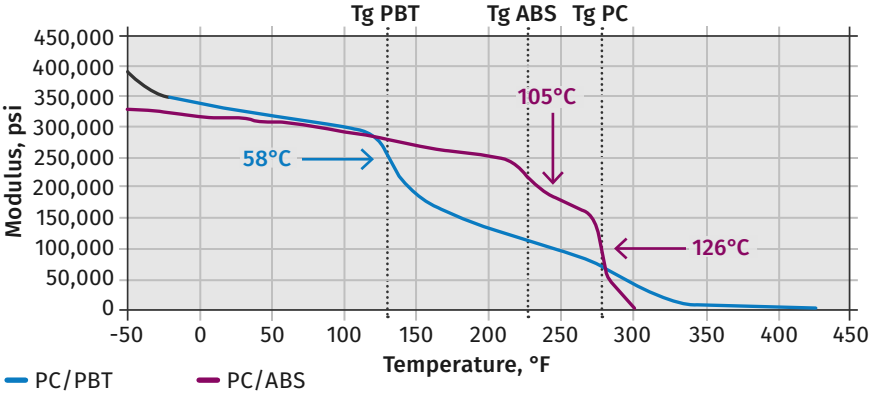
Overall, PC/ABS and PC/PBT have good environmental resistance but with some differences. PBT offers long-term thermal oxidative (TO) resistance above its Tg closer to its melting point. PC and ABS as ►

FIG 1 PC/ABS vs. PC/PBT (DSC)



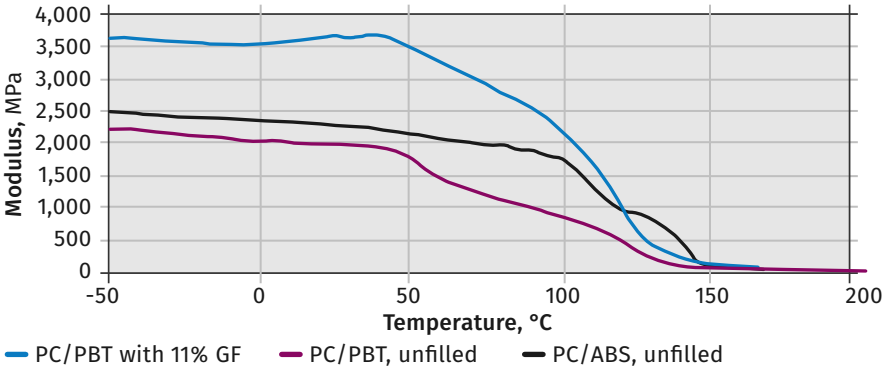
Differential Scanning Calorimetry (DSM) thermograms demonstrating the thermal transition of a PC/ABS blend, PC/ABS alloy and PC/PBT. Source (all images): The Madison Group

FIG 2 DMA Comparison PC/ABS and PC/PBT



Dynamic Mechanical Analysis (DMA) comparison of PC/ABS and PC/PBT. PC/ABS inherently retains mechanical stiffness at higher temperatures than PC/PBT due to the higher Tg of PC/ABS.

FIG 3 PC/PBT With Glass Fiber DMA



DMA comparison of PC/PBT with 11% glass-fiber content compared to virgin PC/ABS and virgin PC/PBT.

TABLE 2 Chemical Resistance Comparison

Chemical	ABS	PC	PBT
Acetone	No	No	No
Toluene	No	No	Limited
Methyl Ethyl Ketone	No	No	Yes
Benzene	No	No	Limited
Ammonia	Yes	No	Yes
Acetic Acid	No	No	No
Glycerin	Yes	Limited	Yes
Isopropanol	Limited	Limited	Yes
Methanol	Limited	No	Yes
Linseed Oil	Yes	Yes	Yes
Paraffin Oil	Yes	Yes	Yes
Petroleum	Limited	No	Yes
Silicone Oil	Yes	Yes	Yes

TABLE 3 Thermal Oxidative Resistance Comparison

Property	ABS	PC	PBT
Short-Term TO Resistance	85-90°C	130°C	200-210°C
Long-Term TO Resistance	70-85°C	120°C	130-140°C

amorphous resins only have TO resistance below that of their Tg. Therefore, TO resistance of PC/PBT would be expected to be higher than that of PC/ABS.

At room temperature, moisture absorption in PC/ABS and PC/PBT is low, but there is poor resistance in PC/PBT to water above 60°C. This is because both PC and PBT are condensation polymers and are susceptible to hydrolysis. While ABS does not undergo hydrolysis, it is not able to overcome the hydrolysis of PC in PC/ABS blends, especially at elevated temperatures. It is not recommended to use either PC/ABS or PC/PBT in hot-water applications.

Both PC/ABS and PC/PBT exhibit a degree of inherent UV resistance. PC and PBT both retain their properties, and yellowing is observed in PC. ABS, specifically the butadiene component, is more susceptible to UV degradation. It is expected that both blends would have fair inherent UV resistance, with some yellowing due to the presence of PC. It's crucial to remember that for applications involving substantial UV exposure, formulations of both PC/ABS and PC/PBT typically include UV absorbers and stabilizers to enhance long-term performance.

TABLE 4 UV Resistance Comparison

Property	ABS	PC	PBT	PC/ABS	PC/PBT
Inherent UV Resistance	Poor	Yellowing	Fair	Fair	Fair

ROUND 6: PROCESSING

PC/ABS and PC/PBT have distinct processing characteristics. PC/ABS is known for its excellent processability, offering good flow and low shrinkage in molding. The ABS component contributes to the good flow properties and low warpage of the blend. PC/ABS can be easily molded into complex shapes with tight tolerances.

PC/PBT also has good processing characteristics but with some differences compared to PC/ABS. PC/PBT typically has higher melt viscosity and higher shrinkage in molding. The PBT component contributes to the higher viscosity and shrinkage. However, PC/PBT still offers good dimensional stability and can be molded into various shapes. It should be noted that because PC and PBT are condensation polymers, they are both susceptible to hydrolysis during molding if proper drying procedures are not followed.

Both PC/ABS and PC/PBT offer a good balance of stiffness and tensile strength but with some notable differences.

THE VERDICT

In the battle of PC/ABS versus PC/PBT, there is no clear winner. The choice between these two polymer blends depends on the specific application requirements. PC/ABS emerges as the champion for applications requiring high impact strength (particularly at low temperatures) and excellent processability. Its combination of toughness, stiffness and dimensional stability makes it a versatile choice for various industries.

TABLE 5 Mold-Shrinkage Comparison

Mold Shrinkage	ABS	PC	PBT	PC/ABS	PC/PBT
Across Flow	0.50-0.70%	0.50-0.70%	1.6-2.4%	0.50-0.70%	0.80-1.0%
Flow	0.50-0.70%	0.50-0.70%	1.5-2.3%	0.50-0.70%	0.80-1.0%

TABLE 6 Overall Comparison

Typical Properties	PC/ABS	PC/PBT
Glass Transition Temperature	Higher	Lower
Stiffness	Good	Good
Strength	Good	Good
Notched Izod at -22°F (ft-lb/in)	High	Low
Notched Izod at 73°F (ft-lb/in)	High	High
Wear Resistance	Lower	Higher
Chemical Resistance	Lower	Higher
Thermal Oxidative Stability	Lower	Higher
Water Absorption	Low	Low
Hydrolysis Resistance	Below 60°C	Below 60°C
UV Resistance	Fair	Fair
Shrinkage	Lower	Higher
Melt Viscosity	Lower	Higher

On the other hand, PC/PBT takes the crown for applications demanding high chemical resistance and good environmental resistance. Its ability to withstand a wide range of chemicals and its durability in harsh environments make it a preferred choice for automotive, electrical and industrial applications.

Ultimately, the best material for a specific application depends on factors such as mechanical properties, chemical resistance, environmental resistance, processing characteristics and cost considerations. By carefully evaluating these factors, engineers and designers can select the polymer blend that best meets the needs of their application (Table 6). PT

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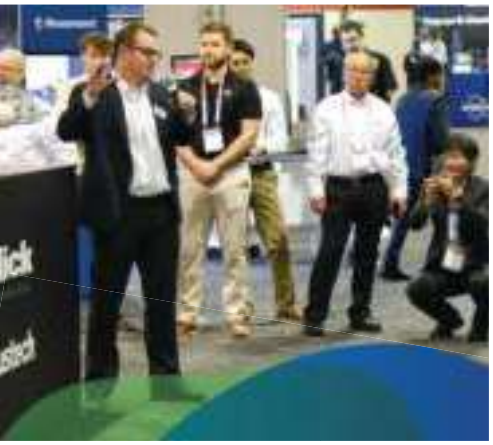

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PET Technologies is one of two OEMs featuring NIR preform heating as standard on its two-stage SBM systems. Source: PET Technologies

Is There a Better Way to Heat PET Preforms for Stretch-Blow Molding?

Is near-infrared (NIR) heating better, faster and more energy efficient? So far, only two machine builders are making such claims for NIR in place of standard mid-infrared preform heating, though their systems appear to be well accepted. Meanwhile, an altogether different alternative is in the works.

By Matthew Naitove
Contributing Editor

Productivity and energy efficiency are two major drivers of technical developments in stretch-blow molding (SBM) and other plastics processes. Near-infrared (NIR), a variant of standard infrared (IR) heating, is said to offer both desired benefits but may not be well known among PET container makers. NIR heating has been commercially available since 2010 but from only two of 14 makers of two-stage PET stretch-blow molding machinery (not counting almost two dozen more builders of such machines in China). Sales of these systems are said to be doing well, however.

Why have so few machine builders adopted this technology to date? How well has NIR heating been accepted by customers, and does their experience confirm claims of faster and more energy-efficient preform heating? Answers to these questions from a

handful of OEMs and molders offer some clarity. Furthermore, one machine builder has a heating system in development that may soon challenge all forms of IR preform heating in two-stage SBM.

WHAT IS NIR & WHY IS IT DIFFERENT?

"Near" infrared is so named because it is the portion of the IR spectrum closer to the visible range of light frequencies. Depending on whose definition you use, NIR frequencies span wavelengths of approximately 714 nanometers (nm) to 2,500 nm. Conventional mid-IR used in preform heating ranges from 2,500 to at least 25,000 nm. The maximum IR transmission rate of PET is said to be from 400 to 1600 nm. Thus, more of the NIR spectrum falls within the range in which PET tends most to transmit rather than absorb the radiation. Why this is important will be explained below.

Note that definitions may vary. One OEM explains that conventional IR lamps for preform heating are best described as in a range between NIR and mid-IR, and their maximum emission range may not be that different from NIR lamps — though that depends on the color temperature at which the lamps are operated.

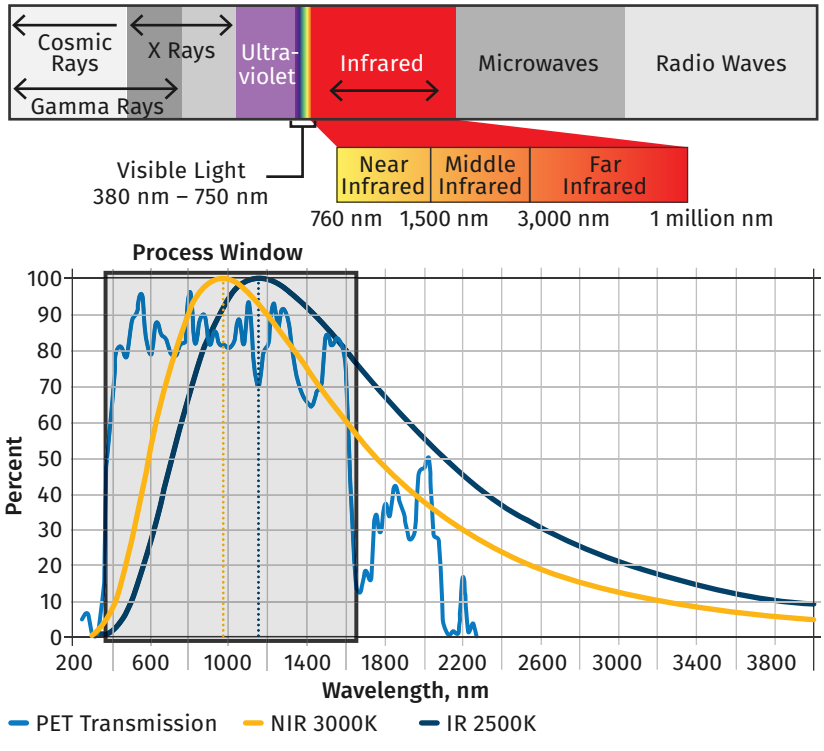
KHS, a German builder of large, rotary SBM systems, introduced NIR heating on its Blomax IV machines in 2010. NIR is standard on the succeeding generation, Blomax V, where it's offered in conventional single-lane or optional dual-lane ovens. The benefits of NIR heating are one of the company's main selling points, and the technology has been "widely accepted since 2010," according to Product Manager Jim Chow.

The only other known supplier of NIR heating for PET SBM is PET Technologies of Austria. NIR was introduced on the company's APF-Max series of linear, all-electric two-stage machines, which was launched in 2016. The company has sold more than 50 of these machines, and demand is growing by 50% annually, largely due to their energy savings, says Tetiana Pronikova, head of marketing.

KHS and PET Technologies agree on how and why NIR heating differs in performance from the usual mid-IR heating, as shown in the accompanying graphic from KHS. "NIR supplies more energy in the range of shorter wavelengths (peak shifted to the left), where PET has a lower absorption rate," Chow explains. "Thus, more radiation can progress deeper into the material before it heats up the PET by absorption. As a result, the preform wall down to the inner surface heats up more quickly, without overheating the outer preform surface — which therefore does not require air cooling — and leads to reduced heating times and more even heating with less temperature gradient through the preform." Ultimately, this means more efficient heating, he says, with lower overall energy usage and better conditions for stretch blowing. For example, tests by KHS under similar conditions showed that when the preform outer surface reached 77°C, the inner surface reached 68°C under NIR, but was at 59°C under mid-IR.

PET Technologies' Pronikova concurs: "Reduced absorption intensity in the NIR range allows the radiation to penetrate PET preforms more deeply and uniformly compared with mid-IR radiation. This allows energy to be distributed throughout the preform volume rather than being concentrated on the surface. NIR's ability to penetrate deeper ensures a more uniform temperature distribution between the inner and outer layers of the preform wall."

She adds that a more uniform temperature profile is especially important in processing recycled PET (rPET), because "rPET requires higher processing temperatures due to molecular changes during recycling," which necessitate "precise thermal control." PET Technologies says this combination of speed and control is likewise particularly valuable in processing asymmetric PET bottles, refillable/returnable bottles, hot-fill bottles and colored bottles. ►



Compared with standard mid-IR radiation used for PET preform heating, NIR spectrum is shifted left toward shorter IR wavelengths. Thus, more of the energy-emission curve is in the region of maximum PET transmission (400-1,600 nm), enabling deeper penetration of NIR into the preform without being absorbed near its outer surface. Source: KHW

PET Technologies introduced NIR heating as standard on its APF-Max series of all-electric, two-stage SBM systems in 2016. Source: PET Technologies

REMSA has an APF-3002 and APF-Max 2, both with two cavities for bottles up to 2 liters. While the output of the APF-3002 with mid-IR heating is 3,000 bottles per hour (bph), the APF-Max 2 reaches 3,300 bph due to the energy-efficient NIR heating system, according to a REMSA source. Also, the shorter NIR oven makes the APF-Max 2 shorter overall by 1 meter than the earlier APF-3002 model. Both types of machines offer the flexibility to process REMSA's more than 20 different PET bottle designs.

THREE BENEFITS ARE SAID TO RESULT WITH NIR:

- **Faster heating:** "Studies highlight that NIR technology achieves near instantaneous heating compared with mid-IR systems, which require longer exposure times," Pronikova says. Notes Chow: "We have seen heating time reduction up to 50%."
- **Energy savings:** "NIR heating systems consume less energy because they minimize heat loss through convective cooling and focus energy directly into the material," Pronikova says. "This translates into significant energy savings — up to 35% in some cases." Adds Chow: "When we compared strictly between NIR and mid-IR in our Blomax III versus current Blomax V machines, we have found up to 40% energy savings are possible with NIR and the newest oven design." He notes that a further 30% savings are possible by switching from a conventional single-lane to a dual-lane oven.
- **Shorter ovens:** "Faster heating enabled by NIR allows for design of shorter ovens in SBM machines," Pronikova notes. "These compact systems save space on production floors and are easier to transport. Compact NIR ovens also require less power to operate." Chow says that up to 50% faster heating means ovens can be up to 50% shorter.

Chow says that several KHS customers have conducted apples-to-apples comparisons of machines with and without NIR heating — using the same preform, material and production speed — and confirmed that the Blomax with NIR saves energy.

WHY DON'T MORE MACHINE BUILDERS USE NIR HEATING?

In Pronikova's view, "The limited adoption of NIR heating by machine suppliers can be attributed to the cost of implementation. NIR heating systems generally require specialized equipment, including high-temperature NIR lamps and precise control systems, which can increase the upfront cost of the machinery compared with traditional mid-IR systems. Development and integration of NIR-compatible systems into existing production lines may involve significant reengineering, which adds to capital expenditures."

Chow had no comment about other OEMs' thinking on NIR, but he did say, "We do not see significant difference in the cost of the heaters between NIR and mid-IR."

One OEM that does not use NIR is Krones AG, a German maker of large rotary SBM systems. Jochen Forsthoevel, in Krones' product

WHAT DO CUSTOMERS SAY?

Recipientes y Empaques de Mexico SA de CV (REMSA) has two generations of PET Technologies' SBM machines: third-generation APF series in two sizes and one model in the fourth-generation APF-Max series with NIR heating. The company uses these machines for applications such as thick-walled PET bottles for wines and spirits. These heavier containers also have asymmetrical shapes.

KHS has offered NIR heating on its Blomax IV and V systems since 2010. Its dual-lane oven option shown here multiplies the energy savings attainable with NIR. Source: KHS GmbH/Reinhold Images

management for plastics technology, does not see significant heating and energy advantages from NIR heating. He notes that the emission spectra of NIR and mid-IR heaters "are not far apart," and "the exact location of the emission maximum is as very dependent on the power with which you operate the emitter (oven output process adjustments). In practical use, all lamps that are used by the big suppliers for preform heating perform very similarly, whether NIR or not."

He further notes that NIR heating technology for preforms "initially was marketed with polished metal mirrors for high reflection." These reflectors have two disadvantages, he claims: "the necessity to clean them often and the unintentional heat profiling of the preform that can result from contaminated reflector surfaces, which can deteriorate the bottle performance and process stability. Thus, they are probably not used so often anymore." Standard IR heating modules, he explains, use ceramic reflectors that are "more or less self-cleaning and create a slightly more blurred heating profile that has shown to be more practical in most cases. Our experience is that a low heating-energy consumption with a big process window for preforms with different wall thicknesses is easiest to achieve with an oven that uses standard quartz lamps and a mainly ceramic reflector on the other side of the preform." (Chow of KHS notes that his firm uses ceramic, rather than metal, reflectors in its NIR ovens.)

WHAT'S COMING NEXT?

"To get a step change in heating efficiency," says Krones' Forsthoevel, "NIR is not the way to go. In our opinion, microwave could be a promising candidate." Krones previewed microwave preform heating in a prototype system at K 2010. The FlexWave oven for its Contiform SBM machine reportedly used up to 50% less energy than conventional IR ovens. "Thanks to the very short heating time, the number of preforms inside the oven has been reduced to a fraction of the former figure, resulting in very low preform losses in the event of an emergency stop," Krones claimed at the time. Heat-up time was said to be only about 3 seconds, or up to 80% shorter than IR ovens. The exceptionally high penetration depth of microwave radiation reportedly enables the preform to be evenly warmed without need for surface cooling or an equilibration time. "No other technology is able to combine very deep penetration, energy density and heating speed in this way," Krones concluded.

Each FlexWave microwave station was fitted with an enclosed cavity resonator. The ability to control each station separately reportedly offers unprecedented process flexibility. What's more, microwave heating is said to be unaffected by the preform color, initial temperature, grade of PET or proportion of recyclate.

Forsthoevel hints that Krones may be able to show the next evolution of the FlexWave system at the next Drinktec show, Sept. 15-19, 2025, in Munich, Germany. PT

High-Quality PCR With Mechanical Recycling Is Within Reach

Successful mechanical recycling of postconsumer materials requires market analysis, understanding requirements and building relationships across the value chain.

Recycled polyethylene. Mechanical recycling can offer lower capital costs, energy usage and greenhouse gas emissions. Source: Nova Chemicals

By Alan Schrob
Nova Chemicals

The postconsumer recycled (PCR) market is at a critical juncture. Despite growing interest in using PCR materials in packaging to reduce virgin plastic use, producers and recyclers report that widespread adoption has been slower than expected. There is a disconnect between recyclers who have the capacity to produce more PCR but lack the corresponding demand, and brand owners who say they struggle with finding PCR suppliers who can deliver materials at scale.

Today, mechanical recycling is the most common and cost-effective recycling method for plastics in the world. Plastics market research from AMI Consulting predicts that the global production of mechanically recycled materials will reach 55 million tons by 2030. Utilizing this existing infrastructure presents multiple opportunities, with techno-economic analysis showing that mechanical recycling requires lower capital costs, lower energy usage and reduced greenhouse gas emissions than other recycling methods.

As brand owners, governments and nonprofit organizations all seek to increase the rate of plastic recycling, how can recyclers help accelerate the adoption of PCR plastic and create materials that meet the needs of the market? A solution that will provide lasting impacts on the production of high-quality PCR materials is an investment in improved mechanical recycling sortation and processing technology. The ability to mechanically recycle more plastics — supported by management of incoming material streams and better sortation — can help recyclers produce high-quality PCR materials that meet the standards of highly regulated applications like food packaging.

Building a circular system requires coordination and relationship building across the value chain.

Many postconsumer plastic bales contain bulk contaminants and mixed plastic types, rendering them difficult for recyclers to work with. In an analysis of materials recovery facility (MRF) post-use plastic film bales, McKinsey found that some contain as little as 50% of PE or PP, while the remaining half is made up of undesired plastics and nonplastic materials. Inconsistencies in incoming materials, such as the wide variety of municipal recycling collections, lead to inefficiencies in the recycling process that add cost and degrade quality of PCR, making it unattractive for packaging applications. Through the development of sourcing and sorting protocols, these inefficiencies can be reduced, opening up more possible end markets for high-quality PCR packaging such as food and beauty applications.

Building a circular system requires coordination and relationship building across the value chain. From educating retailers and customers about the value of PCR plastics to employing the latest sorting technology, the following techniques will help recyclers, PCR suppliers and manufacturers understand the components of a chain of custody and how to go about constructing the supporting networks and operations to produce high-quality PCR and deliver it to the right customers.

ANALYZE MARKET DEMAND

For recyclers looking to start or expand PCR material offerings, it is important to understand the current market dynamics and demands of different industries. ICIS research shows that PCR pricing can be extremely volatile due to the unpredictability of scrap values. While some input streams can be unpredictable, programs that support enhanced sortation — such as store drop-off containers or retailer back-of-house collections — can provide more reliable sources of postconsumer plastics. Increased investment and expansion of sorting procedures and technology combined with new collection opportunities can help increase supply.

Recycled materials used in food-contact applications must meet the applicable safety standards just as virgin materials. Source: Nova Chemicals

Demand for PCR materials is predicted to grow significantly in the coming years. Data from Precedence Research estimates that the global PCR market will grow from $17 billion in 2023 to $47 billion by 2033, with the food and beverage sectors responsible for the highest share.

Some of the largest fast-moving consumer goods (FMCG) companies have set targets to reduce their use of virgin plastic and increase their use of PCR materials, including Nestlé, PepsiCo and Mars Inc., which all participate in the Ellen MacArthur Foundation (EMF) Global Commitment. As EMF signatories seek to meet their goals of incorporating PCR into their packaging, they will need reliable suppliers of high-quality PCR that complies with food-contact and cosmetic regulations.

UNDERSTAND PCR REQUIREMENTS

A chain of custody tracks the use of consumer materials from where they were produced, what they were used to package, how they were transported, and how they were collected and reprocessed. The first step in building this paper trail is understanding what the chain of custody requirements are for the PCR material's end use. Third-party organizations have begun to develop recycling standards and certifications. The Association of Plastic Recyclers' PCR Certification program and Green Blue's Recycled Material Standard both offer certifications with data collection and operations audits, providing potential applicants with a detailed framework of supplier due diligence questions and process requirements.

For food packaging applications, the U.S. Food and Drug Administration (FDA) stipulates that recycled plastic materials must meet the same standards as virgin plastic. A chain of custody that maintains physical traceability is needed to monitor the contents of PCR materials. This involves identity preservation, which is the tracking and verifying of the source of incoming materials; and segregation, which keeps food-contact materials separate from any other recycled content destined for mixed-use bales or industrial uses.

BUILD RELATIONSHIPS

Collecting and sharing information about post-use plastic benefits both consumers and recyclers/producers. Recyclers should work to build relationships with other players throughout the plastics value chain to ensure the right information is being collected and shared. Education about the value of plastic waste is essential.

For retailers primarily focused on waste management, it is important to help them understand the significant impact they can have not only on reduced waste to landfill but also on the supply of PCR plastic, and how their efforts to participate in detailed recordkeeping and collection programs will bolster the reliable availability of scrap materials. It can also be helpful to be involved in the development of protocols used to document procurement and use information for materials like back-of-house films.

For brand owners and retailers, understanding what happens to plastics after their initial use contributes to a clearer picture of their environmental impact and enables transparent communication about their progress toward sustainability goals. Recyclers should work to educate their customers about the options available with PCR, as many brands report they do not know where to source PCR materials. Recyclers should also work closely with MRFs to ►

communicate their desired quality and composition standards so the facilities can work toward meeting those specifications.

EXPLORE COLLECTION OPPORTUNITIES

Exploring new collection opportunities can help contribute to the supply of quality PCR materials. Extended producer responsibility (EPR) legislation is gaining traction in the U.S., and recyclers should understand how the programs will be administered, whether through producer responsibility organizations (PRO) or stewardship plans, and who will be responsible for collecting, sorting and reprocessing.

There are numerous opportunities for collaboration between recyclers, MRFs, resin suppliers, packaging producers, retailers and brand owners to develop collection and supply agreements. For example, resin supplier Nova Chemicals owns a mechanical recycling facility in Connersville, Indiana, and is collaborating with packaging manufacturer and plastic film recycling expert Novolex Holdings LLC to operate it. The facility processes post-consumer plastic films to produce Syndigo recycled polyethylene (rPE), with pellet production currently underway. By 2026, the facility will deliver over 100 million pounds of rPE to the market.

Improving the collection and sortation of recycled materials is a vital step in increasing the availability of recycled feedstock.

As the recycling industry works to expand its infrastructure, it is important to examine different avenues of collection, including store drop-off programs, community collection centers, commercial films and wraps, and other large consumers of plastic materials and food packaging such as event venues and stadiums.

OPTIMIZE OPERATIONS

In addition to managing the source and uses of incoming materials, recyclers need to track the progress and integrity of PCR through their own operations. The latest advancements in sorting technology can help create cleaner feedstocks and optimize productivity. Optical sorters and new hyperspectral cameras are improving the accuracy of sorting procedures, while machinery that incorporates machine learning and artificial intelligence (AI) can provide valuable data about scrap materials. In plants that process multiple types of PCR content, separate sorting lines and silos are effective systems to maintain the segregation of food-contact PCR.

OBTAIN A LETTER OF NON-OBJECTION

Recyclers can help increase customer and consumer confidence in food-contact PCR plastic by obtaining a letter of non-objection

(LNO) from the FDA. An LNO, while not a legal approval from the FDA, nonetheless represents its opinion that the recycler's processes are expected to produce PCR materials that will be suitable for use in food-contact applications.

To apply for an LNO, the recycler must submit a description of its recycling process, demonstrate that contaminants can be removed (often by conducting a challenge test) and indicate the intended use conditions of the material. Designing a process that is viewed as acceptable by the FDA requires a chain of custody, source controls and protocols to prevent cross contamination, and knowledge of current good manufacturing practices (cGMP). Recyclers must also be familiar with the relevant Federal Food, Drug and Cosmetic Act regulations for food-contact substances, including those regulations that apply to any additives present in the source material or added during the recycling process.

SHARE KNOWLEDGE

Mechanical recycling is an important tool in increasing the circularity of plastics. With its broad accessibility and economic and environmental advantages, mechanical recycling will continue to expand. The production of high-quality PCR via mechanical processes is achievable. This new era of plastics production highlights the value of partnerships and collaborations in which experienced suppliers share their individual expertise to advance the common goal of reducing plastic waste. Recyclers are now more closely connected with both resin suppliers and converters which enables the refinement of different PCR products to meet the elevated processing and performance requirements of today's end markets for PCR.

Improving the collection and sortation of recycled materials is a vital step in increasing the availability of recycled feedstock. Advancing the processing options for PCR plastics will benefit the industry as a whole, spurring investment into new recycling infrastructure and technology, and making PCR more cost effective for brand owners. The development of new recycling systems will enable the increased collection of plastics that were previously destined for landfills, such as plastic films and flexible packaging. Transparent chains of custody will enable more post-use plastics to stay in the economy in high-value applications, transforming the way plastic waste is perceived and managed. PT

ABOUT THE AUTHOR: Alan Schrob is director of mechanical recycling at Nova Chemicals. He spent 20 of his 30 years in the plastics industry encouraging circularity in a variety of roles, including business development, marketing and the rigid and flexible packaging markets, including performance films. His work has involved exploring innovation opportunities for downstream applications in plastics and plastics sustainability, and improving plastic circularity. Contact Alan at: *412-490-4000* and *Alan.Schrob@novachem.com*

By Jim Callari
Editorial Director

This Tubing Processor Is Used to the 'Hard Stuff'

Kent Elastomer Products has emerged from its beginnings as a supplier of latex dip tubing to a leading manufacturer of high-end tight tolerance tubes for a range of applications.

Greg Graham is senior director of extrusion operations for Kent Elastomer Products and is a 23-year veteran of the company. Source (all image): Kent Elastomer Products

Kent Elastomer Products Inc. (KEP) started in 1960 as Kent Latex Products, specializing in dipped natural rubber latex tubing. Over the years, the company (a subsidiary of Meridian Industries, Milwaukee, Wisconsin) has added plants and product lines, and even expanded its latex offerings in 2001 with its purchase of dip-molding specialist Precision Latex Inc. But its entry into the extrusion business in 1988 rounded out its product offerings to the extent that its extrusion enterprise now accounts for roughly 50% of KEP's overall sales volume.

KEP operates three plants in Ohio — in Kent, Winesburg and Mogadore. All of its manufacturing facilities are FDA certified, ISO 13485:2016. Mogadore is a 25,000-square-foot facility that houses six extrusion lines tended to by 12 operators and is furnished with a Class 7 clean room, notes Greg Graham, a 23-year veteran of KEP and its senior director of extrusion operations. The extrusion operation runs 24/5, running primarily flexible PVC and TPE tubing for applications in medical/surgical, food and beverage, and most recently biopharmaceutical.

One of KEP's very first extrusion offerings was a sunglass holder that was popular in the 1980s and available in a variety of colors. These tubes were run through a bromination process so the tubing wouldn't be tacky and attach itself to someone's hair. Notes Graham, "Bromination was a process that we have done with latex tubing for years, and for a while we were one of the manufacturers providing tubing for sunglass holders that wasn't tacky."

In short order, KEP started producing tubing for chest drainage and blood-pressure cuffs. Today, Graham estimates that medical applications account for roughly 80% of its business. In the food and beverage space, KEP makes tubes for beverage dispensers common in fast food restaurants, which connect a bag situated in the urn to the spigot. It also supplies tubes used for dispensing nacho cheese. Over the past 12 months, KEP converted nearly 1.7 million pounds of material into tubing.

At first blush, it might be tempting to consider these as commodity tubes sold through distribution networks. Fact is, KEP sells directly to OEMs, produces tubing under tight specifications using the latest inline quality control technologies, and will even perform some light assembly to add value to its extrusion offerings. On the medical side, it will also produce tubing with up to six lumens.

Of KEP's six extrusion lines, the oldest is a 2.5-inch NRM with a 24:1 L/D ratio, four are 2.5 inch, 24:1 L/D extruders from Davis-Standard, and its largest is a 3.5-inch, 24:1 L/D machine from Graham Machinery's American Kuhne brand. Downstream, KEP relies almost entirely on vacuum sizing (the exception being crimped tubing), utilizing Conair's MedLine MedVac tanks, furnished with pullers and cutters. Two of the tanks are Conair high-speed Multi-Pass units, which Graham says, "are lifesavers, production boosters and efficiency builders." Most of what KEP extrudes is cut to length, though it has spooling capabilities as well.

On each line, KEP uses two-axis LaserLinc inline ultrasonic wall-measurement technology for outside diameter (OD). The tubing maker has two offline LaserLinc OD gauges as well. KEP designs its own tooling and works with a local machine shop to manufacture all pins and dies. In development at this writing, Graham discloses, is a pin-design two-lumen tube that will enable the customer to separate the two tubes to connect to fittings that are about six inches apart.

Having six extrusion lines enables KEP to dedicate some lines to specific products. One machine is used exclusively to make tourniquet-band profile extrusions. These are nonlatex surgical tourniquet bands made from a proprietary blend of high-performance materials. The material blend is specially formulated to mimic the desirable physical properties of latex, such as excellent stretch, easy tying and untying, and good grip on the skin.

Other lines are devoted to thin-wall products. Some are generally used for tubing used in food and beverage applications, where there are specific regulatory requirements. Others can be utilized for research and development, and prototyping/sampling. KEP can process any material on any line, though it avoids processing PVC on the 3.5-inch extruder. All tubes made by KEP are monolayer.

Upstream, KEP relies on Maguire Product's four-component gravimetric weigh scale blenders. It feeds materials from gaylords and is a big devotee of Maguire's Sweeper Unloading System. The Sweeper is designed to empty a gaylord or octobin with zero operator intervention during unloading, leaving minimal material by the end of the unloading process. KEP has at least one of these devices on each line, more depending on how many materials are being fed to make a product. Says Graham, "We love them. I think we bought the first one they sold, and now we have six. They just make sure that every pellet goes into the system without needing operators to rake inside the gaylord to get material to the hose."

On each of its six extrusion lines, KEP relies on downstream cooling/sizing, pulling and cutting technology from Conair.

KEP runs tubing down to a 0.030 inch inside diameter (ID) for applications such as orthodontic tubes (which are cut and used as bands for braces) up to roughly a 0.750-inch ID. While it has a capable control system, Graham says KEP relies a lot on pen and paper to track run records, processing set points and the like. "We know what tooling we used, what the screw rpm was, the temperature profiles and vacuum level."

KEP tools are designed in-house and fabricated by a local tool builder.

The company's extrusion business has grown virtually every year since its inception, save for the pandemic period, which mostly impacted its food and beverage business. Graham notes that landing new customers — as was the case with the two-lumen product — and working with existing customers on new projects, have contributed equally to this performance. But Graham also credits many projects to a somewhat unusual source: its material suppliers.

He says, "We have a great relationship with our suppliers. My material reps are in many extrusion facilities and deal with customers at the OEM level that might have a tubing need, and they recommend us regularly. The first thing they notice is how clean our facility is. They tell us, 'Wow, your floors are shiny. The aisle ways are clear. Everything is organized.' So, we 'show' well, and on top of that we are very efficient. We get lots of recommendations based on all of that." KEP mainly buys from Avient, Teknor Apex and Star Plastics.

KEP is also very lean. In 2006, it implemented Lean Enterprise, an improvement strategy based on removing waste from all aspects of its business. As part of that effort, all managers and supervisors are certified in Lean Mastery, and every employee is trained in Lean concepts. KEP conducts 'kaizens'

(improvement projects) each month at all three of its facilities and over 85% of its employees have participated in at least one event.

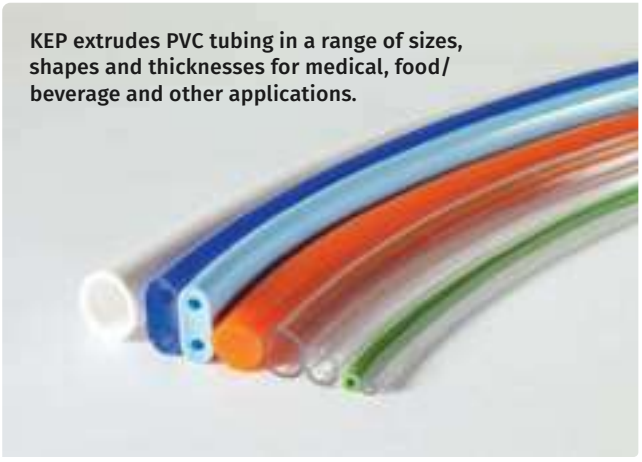
BIG MOVE IN SUSTAINABILITY

On the new product front, KEP recently introduced a line of biopharmaceutical tubing for medicine development and medicine manufacturing. Basically, the tubing is used to convey medicine from one point to another, say for example a large container to a smaller one. This is an application that traditionally has been held by stainless steel or silicone and platinum-cured silicones. KEP's BioVTEX tube is TPE based. Stainless steel tubes for this application can take days to clean, Graham says, whereas silicone-based products might be overengineered and thus too expensive for the task. In the case of BioVTEX, the tubes are merely swapped out.

Given the fact they are ultimately discarded, these tubes are highly engineered so that medicine does not cling to inner walls and create residue. Says Graham, "You don't want the tubing and the medicine to grab to the point where there is residue that gets generated and perhaps moved to the second container. We're competing against some big companies in this space and look at it as a big growth opportunity in 2025, 2026 and beyond. It's a big commitment for us. The testing of the finished products costs hundreds of thousands of dollars to get to the validation stage, but we are beyond that."

Another TPE-based tube is establishing KEP's commitment to sustainability. Also for biopharmaceutical applications, EcoVTEX tubing is produced from a bio-based TPE and offers a 50% reduction in carbon footprint without sacrificing performance.

"We might be smaller than many of our competitors, but we think we are more proactive, and more solution focused," Graham says. "We're big on collaboration; it's not just about churning out



KEP extrudes PVC tubing in a range of sizes, shapes and thicknesses for medical, food/beverage and other applications.

pounds. We have a lot of people coming to us with product ideas where they need prototypes. We turn around prototypes faster than any other place I've worked. We like pushing the envelope, and our customers get a sense of that right away. And when we get it right, the customer sticks with us. Half the time, in fact, we're coaching the customer on the next step they might need to take in product development.

"And customers are not just working with their sales professional. They are working with me and the rest of my technical team. Sometimes John Danes, the president of KEP, is on calls. We've got a long history with some really good customers, and the newer customers tend to stick with us because we got them to the validation state as easy as anyone for a validation. We're used to all that hard stuff — getting the validations, meeting or exceeding the quality standards, delivering product within a two-week lead time." PT

PT Keeping Up With Technology

TOOLING

Thermal Insulating Sheet Targets Highly Stressed Molds

Hasco's rectangular thermal insulating sheets Z12120/... were especially designed for highly stressed molds with strong insulating properties, resulting in high process reliability. Featuring outstanding thermal properties, the sheets have a low coefficient of thermal conductivity in combination with high thermal compressive strength to make them well suited for heat insulation in demanding production processes. In addition to insulative properties, the sheets also provide high chemical resistance for long service life and reliability in extreme conditions.

In addition to the thermal resistance of the Z12120/..., which boosts process reliability, the sheets also provide a reduction in energy consumption. Hasco says use of this thermal insulating sheet can result in energy savings of up to 50%.

Made of high-grade glass fiber fabric and high-temperature resin, the Hasco thermal insulating sheets offer good dimensional stability, in addition to high temperature resistance. The coefficient of expansion of the sheets is comparable with that of steel, ensuring a reliable fit even under extreme temperature conditions.

MATERIALS

Star Plastics PFAS-Free Compounds

Star Plastics, a custom compounder of engineering-grade thermoplastics, has released new polycarbonate (PC) compounds that are free from per- and polyfluoroalkyl substances (PFAS). One PFAS-free product is in the company's Orion engineering resins product line while the other contains recycled content featured in Star's reNova recycled resins.

"These new products address the rapidly evolving regulatory and environmental landscape in the plastics industry today," says Daniel McMullen, Star Plastics CEO. "By giving molders options in the materials they process, they can have a greater impact on preserving the environment and meeting their sustainability goals."

These product formulations are the first in a new category of products for the firm. Existing products carry Underwriter's Laboratories (UL) 94 flame-retardant ratings of V0, V2 and HB. According to the company, compounds with additional UL ratings are in development.

MATERIALS

Neste RE Adds Co-Processed Feedstock

Neste announced its Neste RE brand of renewable and recycled chemical feedstocks is being expanded to include co-processed feedstock. Renewable raw materials such as cooking oil will be co-processed with fossil crude oil in the company's conventional oil refinery in Porvoo, Finland, producing a complement to the existing Neste RE products. According to the company, Neste RE is a drop-in feedstock for the production of plastics and chemicals. Replacing fossil crude oil with renewable raw materials leads to a feedstock with a reduced carbon footprint compared to conventional fossil feedstock used in the chemicals industry.

A mass balance approach will be applied to attribute the renewable raw materials used in the process as well as the related sustainability benefits to the Neste product, which encompasses pure hydrocarbons that can replace fossil feedstocks such as naphtha or propane in plastics and chemicals manufacturing.

"Our goal is simple: reduce the use of fossil raw materials in the chemicals industry," says Jeroen Verhoeven, commercial director for polymers and chemicals at Neste.

BLOW MOLDING

Fast Leak Tester for 'Tricky' Applications

The latest automatic leak tester from ALPS Inspection is the BottleStop system for "tricky" applications like HDPE angled-neck containers, large containers and ones prone to choked-neck defects. Target applications include household toilet bowl cleaners and containers for industrial chemicals and automotive fuel additives. The new unit inspects up to 65 containers per minute with two, three or four heads. Container diameter or length can be 1 to 13 inches

ALPS notes that angled-neck containers require an adjustable probe and secure handling, and containers prone to choked necks also require careful handling for accurate inspection. The new leak tester is described as a cost-effective solution for large, stable containers that often run at slower speeds.

Flexibility and adaptability are prime virtues claimed for the new system. For example, it switches between angled and standard neck containers. A probe for choked necks is optional (choked necks are not easily detected with conventional probes). BottleStop is available in three test-station types: group or individual handling and hold tooling (required for angled necks or for detecting choked necks). The new unit mounts over existing conveyor systems with no major modifications required.

MATERIALS SABIC Polycarbonate Copolymers Resistant to Chemical Exposure

SABIC has introduced LNP Elcres CXL polycarbonate (PC) copolymer resins, featuring chemical resistance. According to the company, these specialty materials are well suited to help customers in the mobility, electronics, industrial and infrastructure markets address increased exposure to harsh chemicals that can cause environmental stress cracking and premature failure. In addition to providing high chemical resistance, LNP Elcres CXL copolymer resins can enhance part durability and reliability with low-temperature impact resistance and weatherability.

SABIC's internal testing revealed that LNP Elcres CXL copolymer resins are highly resistant to diverse chemicals found in the mobility, industrial, infrastructure and electronics sectors. Representative mobility and infrastructure chemicals were tested. They included gasoline, antifreeze, caustic soda (5% solution) and a number of related chemicals. For industrial applications, testing against typical chemical exposures included tar remover, brake fluid and many other substances. In cases where consumers interact with mobility, industrial and infrastructure devices, LNP Elcres CXL copolymer resins can offer improved chemical resistance to the components found in hand creams, sunscreens, insect repellents, cleaning solutions and hand sanitizers.

The new SABIC CXL portfolio offers a wide range of products, including opaque and transparent nonflame-retardant (FR) grades, opaque, thin-wall FR grades and glass-reinforced options.

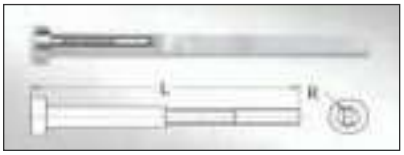
These materials also deliver nonbrominated/nonchlorinated FR at thin gauges, low-temperature ductility (down to -60°C), high flow for easy processing and good colorability to meet aesthetic requirements. They can meet both ultraviolet (UV) and water immersion requirements (F1 rating) for outdoor suitability under UL 746 C.

HOT RUNNERS Hot Runner Design Prevents Overheating, Excessive Heat Loss

Heitec Heisskanaltechnik (Burgwald, Germany) is introducing he Primo line hot runner nozzle series in North America through Technoject Machinery. Available in nozzle lengths of 50, 60, 80, 100 and 120 mm, Heitec says the Primo line provides precise temperature control and management. Featuring melt channel diameters in 3, 5 and 6 mm for the standard nozzle, there are also melt channel diameters of 5 and 6 mm for the Primo valve gate system. Heitec says that optimized thermal separation between the nozzle and mold help prevent overheating, as well as heat loss. Provided with quick availability, Heitec says downtime can be reduced and maintenance simplified because of the on-site replaceable tip, heater and thermocouple. Direct injection tips can further reduce waste and ensure precision.

TOOLING Expanded Blade Ejector Line

Progressive Components has expanded its line of blade ejectors, which include newly offered optional features to reduce in-house machining. Referred to as "Mold-Ready," these ejectors are delivered with features that have traditionally been added postpurchase in the toolroom. In addition, the company says configurable part numbers eliminate the need for a print to be provided.



Specifically, Progressive says these configurable part numbers simplify ordering Blade Ejectors with radii. Additional Mold-Ready features that can be provided via configurable part numbers include finished cut-to-length, flat machined on head or serial engraving for blade identification. If sizing doesn't allow the use of a standard part, Progressive provides custom, made-to-order blade ejectors per print, template or CAD model.

Prices Generally Trending Upward for the Five Commodity Resins

Scheduled and unscheduled production disruptions, and projected higher feedstock costs could be key factors.

By Lilli Manolis Sherman
Contributing Editor

Barring weather-related or other unscheduled production interruptions, prices of the five major commodity resins were still projected to be on an upward trajectory at press time. This is despite slowed domestic demand, the overall buyers' market experienced during 2025 contract negotiations at the end of 2024 and the fact that the International Longshoremen's Association (ILA) reached an agreement before the end of January to avert a strike in the nation's East and Gulf Coast ports. Contributing factors for the upward trend include heavier than usual scheduled turnarounds for key feedstocks and resins, and higher trending feedstock prices in some cases.

Prices of the five major commodity resins are projected higher despite slowed domestic demand and the buyers' market experienced at the end of 2024.

These are the views of purchasing consultants from Resin Technology Inc. (RTi); senior analysts from Houston-based PetroChemWire (PCW); CEO Michael Greenberg of The Plastics Exchange (TPE); Scott Newell, executive VP polyolefins at distributor/compounder Spartan Polymers; and Mike Burns of Plastic Resin Market Advisors.

PE PRICES FLAT TO UP

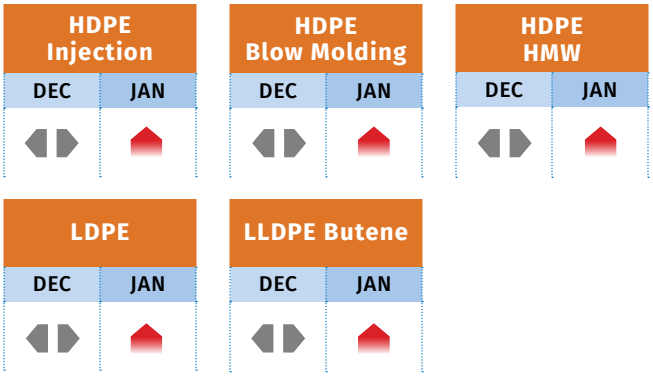
Polyethylene (PE) prices rolled over in December and suppliers were out with January increases of 5 to 7¢/lb, of which partial implementation was possible within the first couple of months, according to David Barry, PCW's associate director for PE, PP and PS; as well as TPE's Greenberg; Mike Burns of Plastic Resin Market Advisors; and Kevin Mekaru, RTi's senior business leader of commodity plastics.

Still, nonmarket discounts were widely reported by buyers during end-of-year contract negotiations, according to PCW's Barry. He noted that inventories appeared plentiful, and buyers said suppliers would have a hard time implementing a price hike in January, particularly if the December industry data showed another inventory build. Pointing out that PE suppliers officially only gave back 3¢/lb out of the 2024 price hikes of 13¢/lb, RTi's Mekaru ventured there was potential for implementation of a 3¢/lb increase in January with a rollover this month.

Market Prices Effective Mid-January 2025

Resin Grade	¢/lb
POLYETHYLENE (railcar)	
LDPE, LINER	60-62
LLDPE BUTENE, FILM	57-59
HDPE, G-P INJECTION	57-59
HDPE, BLOW MOLDING	55-57
HDPE, HMW FILM	60-62
POLYPROPYLENE (railcar)	
G-P HOMOPOLYMER, INJECTION	53.5-55.5
IMPACT COPOLYMER	56.5-58.5
POLYSTYRENE (railcar)	
G-P CRYSTAL	92-94
HIPS	97-99
PVC RESIN (railcar)	
G-P HOMOPOLYMER	53-55
PIPE GRADE	54-56
PET (truckload)	
U.S. BOTTLE GRADE	58-60

Polyethylene Price Trends



Citing American Chemistry Council supply/demand data for November, TPE's Greenberg noted that domestic PE sales declined for the fourth straight month — down 5.6% compared to the 12-month average — to reach their lowest level since November 2023. Meanwhile, PE suppliers produced a record amount of resin, primarily driven by strong export demand. "Exports soared ►

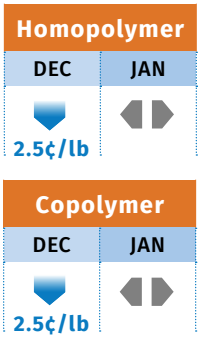
to their highest ever and, for the first time, actually exceeded total domestic sales," Greenberg says. Between 45-51% of North American PE production goes to exports.

According to Plastic Resin Advisors' Burns, if suppliers were to maintain November's high production rates, 2025 resin production could potentially increase by 7% or 5 billion lbs. "Allowing a generous 3% domestic demand, suppliers would need to export an additional 5% of production to maintain a balanced inventory," Burns says.

PP PRICES DOWN, THEN UP?

Polypropylene (PP) prices dropped by 2.5¢/lb in December, in step with propylene monomers, but were expected to have bottomed out going into January, with a more than likely upward trajectory going forward, according to PCW's Barry, Spartan Polymers' Newell, TPE's Greenberg and Paul Pavlov, RTi's VP of PP and PVC. Spot monomer prices were firming up and, as TPE's Greenberg reported, prices for propylene and PP would be higher within the year's first quarter. RTi's Pavlov ventured a potential 3 to 5¢/lb increase was possible.

Polypropylene Price Trends



PCW's Barry emphasized that propylene supply factors, rather than demand, were the driving force, with industry reports of a heavier than typical turnaround season for refineries and steam crackers. These sources all noted that demand was particularly slower in the fourth quarter of 2024, with PP plant operating rates having been reduced to below 70%. Newell said the industry sentiment on PP demand going into 2025 was bearish. Barry added that a global oversupply of PP was another factor with China now selling lower cost PP in South America and buying interest in exports was low at year's end. "Most North American PP producers lacked competitive feedstock economics to match available pricing from Asia," Barry says, "and traders were focused on exporting PE."

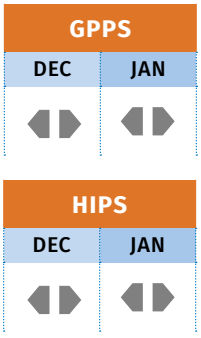
All sources ventured that demand from sectors such as consumer goods and automotive could well pick up but more so in the second quarter. They also noted that processors continued to work through resin stocks they had built up through much of 2024's second half, which were largely as a cushion to withstand hurricane season production disruptions.

PS PRICES FLAT FOR NOW

Polystyrene (PS) prices appeared to have largely rolled over at the end of the fourth quarter and could continue that way in the first couple of months of 2025, according to PCW's Barry and RTi's Pavlov. Still, Pavlov noted that there were many nonmarket discounts in the 1-to-2¢/lb range at the end of last year. Those were in addition to last October's 3¢/lb drop, following six months of flat pricing.

Both sources noted that PS demand continued to be low, with plant operating rates in the 50% range by year's end. Barry characterized spot PS resin availability as merely adequate as suppliers dropped operating rates to match firm orders. By late December, he reported that the implied styrene cost based on a spot formula of 30% ethylene/70% benzene was flat versus the previous month. Both sources saw a potential upward pricing trajectory coming from an uptick in benzene or styrene monomer prices due to weather-related disruptions.

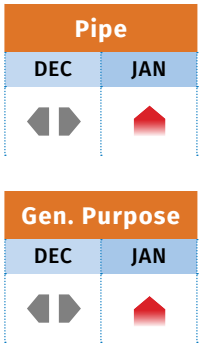
Polystyrene Price Trends



PVC PRICES UP?

PVC prices were expected to move up 1 to 2¢/lb in January, as most suppliers were out with increases of 5¢/lb, with February prices to roll over from January, according to RTi's Pavlov. This, after having dropped 3¢/lb in the fourth quarter of 2024, driven by both slowed domestic and exports sales, along with significant supplier inventory buildup. Plant operating rates were in the mid-70s percentage-wise, and there was concern about potential impact of the new U.S. administration's possible tariffs on PVC imports.

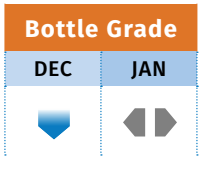
PVC Price Trends



PET PRICES FLAT TO UP

PET prices were expected to be flat to up within the January-February time frame, after dropping 5¢/lb in the fourth quarter of 2024. This is based on raw material formulation costs, which were expected to be a bit higher due to both scheduled turnarounds and the potential of weather-related disruptions, according to RTi's Mekaru. Demand was softer and there was ample supply resulting from domestic production and well-priced imports. However, here too there was concern in the industry of how the new U.S. administration's proposed tariffs on imports would impact PET's supply/demand balance and overall pricing.

PET Price Trends



QUESTIONS ABOUT MATERIALS?

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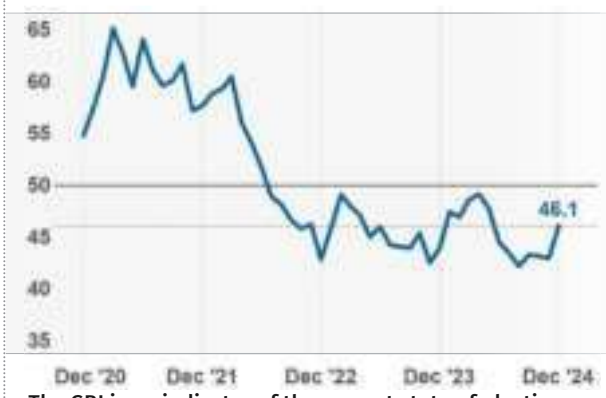
Find the latest plastics processing market research and reporting at **GardnerIntelligence.com**

Plastics Index Shows Fourth Consecutive Monthly Gain

December reading hints at slowing contraction as plastics industry outlook improves.

FIG 1 Plastics Processing Index

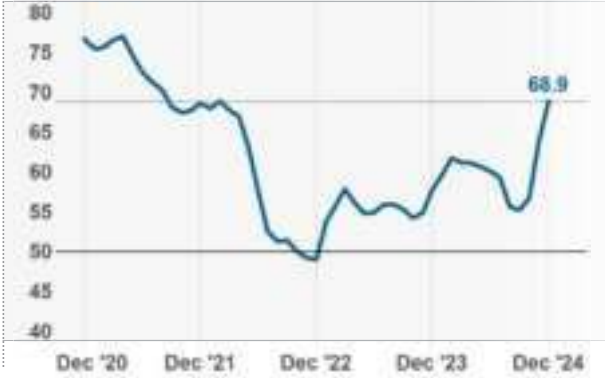


The GBI is an indicator of the current state of plastics processing. Over 50 is expansion. Under 50 is contraction.

FIG 2 Components Scorecard

Shade = distance from 50 (darker shades are further from 50)
Direction = change (Pointing up is better)

FIG 3 Future Business Index



Numbers in Perspective

The Gardner Business Index (GBI) for December rose to 46.1, which is higher than in previous months but still indicates a weaker business environment for the plastics industry. New orders and production components of the GBI increased both month-over-month and year-over-year. Year-end performance varies by industry: service sectors, like travel, typically experience strong growth in December due to the holiday season, while manufacturing often slows, except for efforts to address backlogs or meet year-end shipment deadlines. Notably, the backlog component of the GBI showed a monthly increase in December, though it remained lower than the same period last year.

By Perc Pineda

In 2024, the plastics industry faced its second consecutive year of sluggish manufacturing performance, even as the broader U.S. economy expanded. Manufacturing output — the primary driver of demand for plastics — declined, while the housing sector experienced reduced activity, as evidenced by falling housing starts and lower existing and new home sales. Weak manufacturing performance can be attributed to high inventories, while the housing sector faced challenges due to postpandemic underbuilding and low housing supply as homeowners avoided selling to evade higher mortgage rates. Although immigration has been cited as a factor in economic growth last year, policymakers must recognize that while immigration has supported the services sector, its benefits to manufacturing has been minimal. Looking ahead to 2025, lower interest rates are expected to boost demand across the industry's value chain. Notably, the future business component of the GBI rose to 68.9 on a 3-month moving average. PT

ABOUT THE AUTHOR: Perc Pineda, Ph.D., chief economist of the Plastics Industry Association (PLASTICS), is an industry thought leader and PLASTICS' primary expert and spokesperson on the U.S. and global economy, industry research, statistics, trends and forecasts. He produces PLASTICS' two annual flagship publications — *Size & Impact* and *Global Trends* — and trademarked the Global Plastics Ranking. Read his views and insights on the economy and the plastics industry at *plasticsindustry.org*.

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COMBERPLAST — SAN BERNARDO, CHILE

Pursuing More Sustainable Plastic Pallets

Chilean lithium producer employs local molder with a specialized Engel duo 2-platen press to shift to pallets made from reclaimed plastics.

By Tony Deligio
Editor-in Chief

In business for 50 years, Comberplast has spent the last 25 of those years specializing in integrating recycled material into its injection molding, including adding in-house capacity for resin reclaim. Over the last eight years, it has further refined that focus into a new venture, Atando Cabos, which roughly translates from Spanish to "connecting the dots."

The dots here are the various points along a custody chain that touch a plastic product. These products, despite the utility of the material they're made from, have become environmental waste in their end of life. "We love plastic, but we also love nature," explains Beltrán Orrego, development manager at Atando Cabos. "Whenever we see plastic where it shouldn't be, we start figuring out how to fix the problem. How are we going to connect the different players of the value chain to be able to recover plastics from places they shouldn't be?"

From left, Julio Compagnon and his son, with Julia Kuehhas and Klaus Fellner, of Engel, at Engel's tech center in St. Valentin, Austria. Source: Engel

The first misplaced plastic waste it recovered — and dots the company connected — came from the salmon farming industry in southern Chile's Patagonia region. On vacation there, Michel Compagnon, Atando Cabos' co-founder and Comberplast commercial manager, was struck by the region's natural beauty and the presence of fishing waste in the form of nets and ropes. When Compagnon packed for home, he included some of the ropes found in Patagonia, hauling them back to Comberplast to see if the plastic was salvageable.

After some testing, Comberplast determined the detritus was reclaimable, and today the company's facility continuously receives trucks hauling fishing industry waste from Chile's south after connecting the relevant dots among the local fishing industry, government and waste management there.

Atando Cabos' reclaimed material was molded into floor tiles at machine partner Engel's NPE2024 booth. At the show, Atando Cabos initiated its latest dot-connecting venture, purchasing a specialized Engel press to mold reusable plastic pallets from reclaimed materials for one of the largest suppliers of lithium in the world, Santiago-headquartered SQM Lithium. SQM uses the pallets to ship bulk bags of lithium and its derivatives all around the world.

After SQM reached out to the Chilean branch of Rehrig Pacific Company (RPC) — a leading pallet provider to the region and a key business partner of Atando Cabos that recovers and transforms material into RPC pallets — about sourcing pallets from its reclaimed material, it realized it might have internal plastic waste that could also be reclaimed. SQM, RPC and Atando Cabos did testing and verified that the lithium producer's plastic scrap could also be incorporated. "[SQM] is not only going to be removing as much material as they can from the south," Orrego says, "but they're also going to be using as much material as they can from their own operations."

The NPE-purchased 2,200-ton two-platen hydraulic duo 51060/2000 tech PRO will run a new stack tool for the custom pallets, which feature steel inserts, with production scheduled to begin in January 2025. Normally, pallet molding at Comberplast entails batch work for the two-piece parts, so there's a production run of top halves before switching to bottom halves. For the SQM job, however, the new stack mold, running 24/5, will enable Comberplast to mold both halves of the pallet simultaneously. Outfitted with Engel's iQ weight control, weight monitor, melt control and clamp control, the optimized press is Comberplast's eighth Engel machine, with previous presses ranging in clamp force from 250 to 1,100 metric tons. Comberplast's and Atando Cabos' willingness to experiment has made it a valued "testing" hub for equipment and material suppliers.

"I think one of our main benefits or values is we are very brave/crazy when it comes to trying new things," Orrego says. "Collaboration is a word that's used too much sometimes, but this is a collaboration in the real sense — every time it is connected to a real kilogram of material being reclaimed." PT

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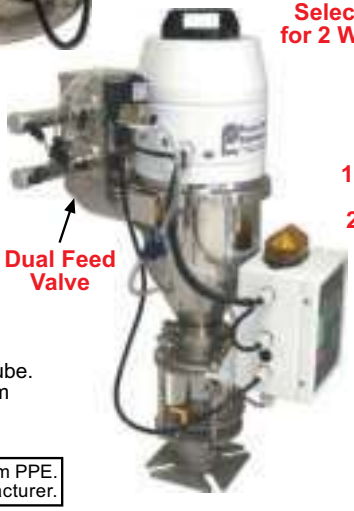

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