spe Thermoforming Quarterly®

Fourth Quarter 2019 | Volume 38 | Number 4

A Journal of the Thermoforming Division of SPE

Stuck On You

IN THIS ISSUE:

- K2019 Technology Review
- Recycling Multilayer Structures
- Thermoset Adhesives

Hello! Meet Perry.

SIMONA PMC
Extrusion Operator

"I love the team atmosphere.

The people are great to work with and I have made many good friends. The job changes on a daily basis keeping things interesting and challenging."

–Perry Hartley

MORE THAN JUST SHEET, EXPERIENCE THE SIMONA PMC DIFFERENCE!

Our team of extrusion professionals and material experts will help you find the best material for your demanding applications.

TPO | ABS | ACRYLIC | ASA | PC/ABS | Soft-touch & MORE!

REALIZE THE SIMONA PMC DIFFERENCE

877.289.7626 // sales@simona-pmc.com // simona-pmc.com

SIMONA PMC

spe Thermoforming Quarterly®
Fourth Quarter 2019 | Volume 38 | Number 4

Departments

Features

In This Issue

People's Choice Award: Two-Sheet Glued Versatile Cab Roof from Plastics Unlimited (photo courtesy of Dallager Photography)

A JOURNAL PUBLISHED EACH CALENDAR QUARTER BY THE THERMOFORMING DIVISION OF THE SOCIETY OF PLASTICS ENGINEERS

www.thermoformingdivision.com

Editor
Conor Carlin
(617) 771-3321
cpcarlin@gmail.com

Sponsorships
Lesley Kyle
(914) 671-9524
lesley@openmindworks.com

Conference Coordinator
Lesley Kyle
(914) 671-9524
lesley@openmindworks.com

SPE Thermoforming Quarterly® is published four times annually as an informational and educational bulletin to the members of the Society of Plastics Engineers, Thermoforming Division, and the thermoforming industry. The name, "**SPE Thermoforming Quarterly®**" and its logotype, are registered trademarks of the Thermoforming Division of the Society of Plastics Engineers, Inc. No part of this publication may be reproduced in any form or by any means without prior written permission of the publisher, copyright holder. Opinions of the authors are their own, and the publishers cannot be held responsible for opinions or representations of the authors. Printed in the U.S.A.

SPE Thermoforming Quarterly® is registered in the U.S. Patent and Trademark Office (Registration no. 2,229,747).

Chairman's Corner – Q4 2019

Eric Short

The 4th Quarter edition of our magazine is usually when we feature a review of our annual conference and this issue is no different. With an outstanding array of parts competition winners (wonderfully captured by Ellen Dallager, our long-time photographer) the 2019 conference highlighted many new innovations that embody the spirit of thermoforming. In keeping with tradition, this magazine cover features the People's Choice Award, won this year by Plastics Unlimited. Bill Bregar, senior reporter from Plastics News, graced the show floor again this year and provided an excellent summary of the conference and the Parts Competition. Congratulations to the winners, and thank you to those who submitted parts and to those that helped to organize the event.

2019 marked the 25th anniversary of the Plastics News annual "Thermoformers Ranking" feature. In 1994, Mobil Chemical was listed as the #1 thermoforming company in N. America (see pp. 6-9) for news summary). We also saw plant closures and new investments in our sector, proof that the economy continues to be dynamic.

This year was also a "K" year, when the plastics world descended on the cobblestoned streets of Düsseldorf, Germany, for an 8-day technology extravaganza. Compared to 2016, this year's event saw slightly lower attendance, though many exhibitors reported solid, if not booming, business. Mark Strachan, former Division Chair, compiled a survey report of developments in machinery from the global marketplace (see pp. 34-35). A major theme of the fair was "Circular Economy", with a conspicuous number of companies staking claim to environmental responsibility.

Work continues, however, to improve recycling technologies for the ever-increasing supply of plastic packaging. Despite rumors to the contrary, California still attracts business investment where a strong rPET market is showing signs of diversification as processors focus on separating bottles from thermoforms (pp. 40-45). In Europe, meanwhile, companies like Kuraray are pressing ahead with field studies examining the ability of reclaimers and recyclers to use multilayer packaging containing EVOH in the PP recycling ecosystem (pp. 22-32). Those who follow such conversations online or on the conference circuit cannot fail to notice the inherent tension among consumer demands, brand promises and economic realities.

Following feedback from our exhibitors, attendees and supporters, it has become clear that putting on an annual conference has become too much. Markets and changing, and we must change with them. We've hosted one of the best conferences in the SPE family for 25 years, raising funds for students and pursuing our mission to advance the science and technology of thermoforming. 2020 will see more changes, no doubt, but we will continue our work to support the thermoforming industry through scholarships and matching grant programs under the SPE banner. This wasn't an easy decision, but it was the right one.

I encourage all of our members to get involved – stay involved – with your local SPE chapters, schools, and suppliers to build and strengthen the ties that make our industry thrive. Sponsor the PlastiVan, sponsor a school visit, offer to give a paper at another conference. Volunteerism requires effort, though we are all the better for it. |

VULCAN
Plastics Technology Co Ltd

Thermoforming Tooling Manufacturer

Quick turn around time

From simple piece inserts, mold plates, to a complete tool, from efficient cut-in-place contact heat tooling to a deep draw plug assist tool with a trim process, from PET, PE, PVC, PP, OPS, PS to compostable PLA, we are ready

Reliable quality

Vulcan follows ISO9000 procedure.
Vulcan pays attention to all details
In Vulcan, no detail is too small.
Vulcan follows a step by step quality inspection process.
Vulcan tests the tool before shipping.
Vulcan carefully packs the tool to ensure they arrive in pristine condition.
Vulcan follows up after the sale.
we are responsible; we keep improving....

Design

No matter if you just have an idea sketch or a complete drawing, our design and production team will utilize their experience in the packaging industry to meet your customer needs. You will find that we know plastic packaging, we have the skills to convert your ideas into products. We are able to provide flat drawings, 3D drawings and even prototype parts to help you with the demands and needs of your customer.

Prototype

Your customer needs to see a sample before confirming an order? Not a problem, just ask for our test sample service. We may be able to help by finding some available machine time.

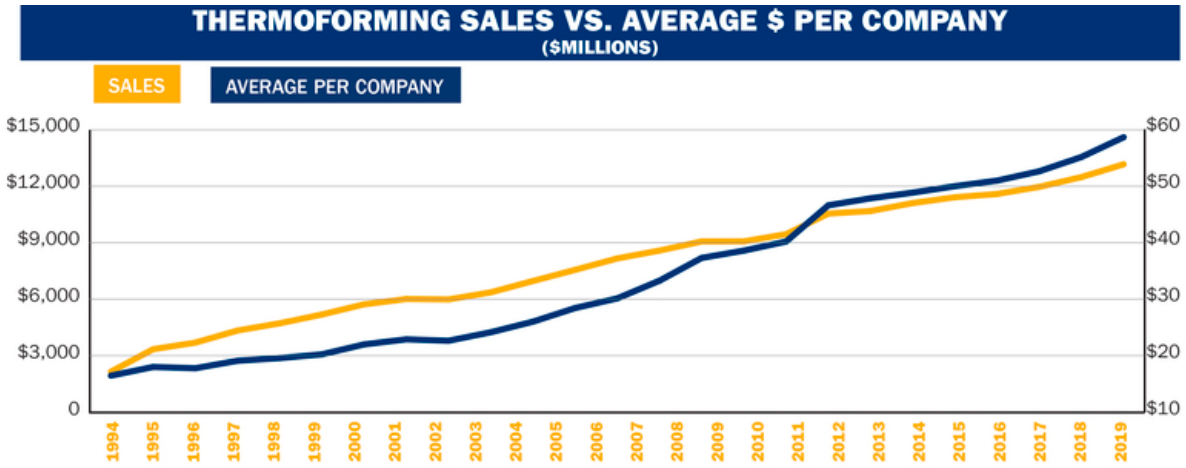
Mass production

In the design process of formulating a reasonable programme to meet the requirements of mass production.

www.vulcanplastics.com
www.vulcanplastics-na.com

Marking 25 Years of Ranking Thermoformers

Hollee Keller, Plastics News Staff



October 11, 2019 – 1994 was the debut of our very first ranking of North American thermoformers. Then-reporter Don Loepp was the researcher behind this project. He introduced our readers to 134 thermoforming companies. Mobil Chemical Co. was No. 1 on the list.

Fast forward to today, and our 2019 ranking included 225 firms. The No. 1 company in the ranking has changed only twice in 25 years, but both times it was primarily the result of a change in ownership: Tenneco's Packaging Corp. of America unit bought Mobil's plastics division for $1.27 billion in 1995, and then Tenneco spun off the packaging unit in 1999 to create Pactiv Corp., now Pactiv LLC.

Three No. 1 companies, but all can trace their ancestry to Mobil Chemical.

Tracking the total ranked sales across all 25 years and comparing it to the average sales per company is a way to even out the billion-dollar gap between the largest and smallest molders.

The 355 percent growth for our average ranked company is impressive, but how does that compare to feedstock costs? After all, plastic sheet and energy are major expenses for thermoforming companies.

Well, to put it into perspective, crude oil was at $14.28 per barrel in 1994 and natural gas was $1.88 per million metric British thermal unit (MMBTU). At the time of writing, prices are $56.11 per barrel (WTI) and $2.86/MMBTU.

Plastics News' pricing history for the most popular resins used in thermoforming didn't begin until 1997. For ABS, polystyrene and high-density polyethylene, using 1997 figures, we see increases of 70, 60 and 100 percent, respectively.

Finally, some thermoforming trivia: The Society of Plastics Engineers has given its Thermoformer of Year award since 1982. With 38 winners in total, 25 of them were employed by thermoformers at the time they won the award. The rest worked as consultants, were retired or worked for machinery or material suppliers.

German Thermoformer to Open $9.8M Alabama Plant

Plastics News Report

October 15, 2019, Auburn, AL – German thermoformer Durotherm Kunststoffverarbeitung GmbH is opening its first U.S. operation, a $9.8 million investment that will operate as ID Plastics LP.

The Auburn facility will employ 50, launching production with the ID Pack Sleeve returnable container, Alabama Gov. Kay Ivey announced in an Oct. 14 news release.

Brothers Martin and Andreas Hartl are forming the company to bring the combined expertise of Durotherm, based in Heiterbach, Germany, and extrusion specialist Infinex Group to the U.S.

A NEW GENERATION 125 TON THERMOFORMER FOR SOLID SHEET

The Model 45 doesn't require a 3rd motion or airbox. A smart SASH (Servo Adjust Shut Height) monitors an accurate measuring system to maintain the newly designed platens at +/-.002" flatness.

- Air cylinders operate the sheet clamp frame.
- The bottom platen drives the plugs.
- **Option: can be ordered 52" wide.**
- Max. product depth 5"
- Shut height 30"
- Sheet width 48"
- Sheet line 53.5"

- More Power
- Less Air
- Faster Cycle
- Less Cost

Phone: (509)248-0194
www.irwinresearch.com
sales@irwinresearch.com

IRWIN Research & Development

The companies already have U.S. customers, which prompted the project.

"German technology made in the U.S.A. with state-of-the-art, customer-oriented manufacturing. That's the perfect combination, the way we see it," Andreas Hartl noted in the release.

Michigan Kayak Molder Closing, Cutting 68 Jobs

Bill Bregar, *Plastics News* Staff

October 31, 2019 – Kayak manufacturer Hemisphere Design Works is laying off at least 68 workers and shutting down its headquarters operation in Muskegon, Mich., according to a notice filed with the state.

Hemisphere Design Works, formerly KL Outdoor LLC, does rotational molding and thermoforming of kayaks, paddleboards and other sports recreation products. The company once employed more than 200 people at the Muskegon factory, according Plastics News ranking data and published reports about the closing.

Company officials could not be reached for comment. But the company filed a notice with the state of Michigan on Oct. 29, detailing the closing of KLO Holdings, doing business as Hemisphere Design Works. Operations in Muskegon will close by Dec. 29. Layoffs began the same date the WARN paperwork was filed.

"The company has been in the process of seeking capital which, if obtained, would have enabled it to avoid or postpone a closure and continue operations. Unfortunately, the company's efforts have not been successful and the company has unexpectedly learned that the term lender will not provide additional funding," the kayak maker said in the notice.

The abrupt closing came about two years after the company announced a $9.2 million investment and plans to hire 153 people in Muskegon.

In 2017, New Water Capital LP, a Boca Raton, Fla.-based private equity company, bought Muskegon-based KL Outdoor from a Detroit-based investor group. New Water then bought Canadian kayak producer GSC Technologies. The private equity firm merged the two firms to create Hemisphere Design Works.

At the time, a New Wave official said combining KL and GSC created the only vertically integrated kayak manufacturer with rotomolding, thermoforming, blow molding and injection molding capabilities. Hemisphere Design Works claimed to be world's largest maker of kayaks, with 30 percent of the market through its brands including Sundolphin, Evoke, Future Beach and Terrain. Those brands include kayaks, canoes, pedal boats, dinghies, paddleboards, fishing boats, hunting blinds and sleds.

Plastics News' most recent ranking data reported Hemisphere Design Works generated estimated thermoforming-related sales of $35 million and an estimated $12 million in rotomolding sales.

Jim Fox replaced Chuck Smith as Hemisphere's CEO earlier this year.

SPE Thermoforming Conference Going to Every Other Year

Bill Bregar, *Plastics News* Staff

November 04, 2019 – The Society of Plastics Engineers' Thermoforming Division is changing its annual conference from every year to every other year, officials announced Nov. 4.

The division has canceled plans for the 2020 SPE Thermoforming Conference and will hold the next conference on Sept. 20-22, 2021 in Grand Rapids, Mich.

"For the past several years, the division's board of directors has received feedback from attendees, sponsors and exhibitors that an annual conference is no longer what the industry needs," said Eric Short, chairman of the SPE Thermoforming Division. "The board felt that it was time to

act by moving the conference to every other year. It wasn't an easy decision, but we are convinced that it was the right one."

Short added that the division plans to enrich the content of the conference and minimize conflicts with other events.

"Our challenge as a board is to develop creative strategies to continue to fulfill our mission during the non-conference years," Short said.

The 2019 conference, held Sept. 9-11 in Milwaukee, drew 534 people.

Sonoco to Acquire Healthcare Packaging and Medical Device Thermoformer

Yahoo Finance

HARTSVILLE, S.C., November18, 2019 (GLOBE NEWSWIRE) -- Sonoco (SON), one of the most sustainable, diversified global packaging companies, today announced it has signed a definitive agreement to acquire Thermoform Engineered Quality, LLC, and Plastique Holdings, LTD, (together TEQ), a global manufacturer of thermoformed packaging serving healthcare, medical device and consumer markets, from ESCO Technologies, Inc. (ESE) for approximately $187 million in cash.

TEQ, headquartered in Huntley, Ill., produced sales of $88 million in the fiscal year ended September 30, 2018, and operates three thermoforming and extrusion facilities in the United States along with a thermoforming operation in the United Kingdom, and thermoforming and molded-fiber manufacturing in Poland. Each facility has state-of-the-art cleanroom capabilities, enabling the production of sterile, barrier packaging systems for pharmaceuticals and medical devices. In addition, TEQ produces recyclable, molded-pulp-fiber packaging and thermoformed plastic packaging for multiple consumer products primarily in Europe. The company has approximately 500 associates.

"Recent studies value the global healthcare packaging market at approximately $33 billion, with healthy growth expected for the future," said Rob Tiede, Sonoco President and CEO. "Increased life expectancy, the steady introduction of new products from medical device manufacturers and pharmaceutical companies, combined with requirements for improved safety and compliance, are driving market growth. TEQ provides a strong platform to further expand Sonoco's growing healthcare packaging business, which includes our best-in-class ThermoSafe™ temperature-assured pharmaceutical packaging; injection-molded vials, multi-cell cuvettes and appliances; thermoformed trays for medical devices and OTC medical products, along with our Alloyd heat-sealing equipment for commercial medical applications."

TEQ President Randy Loga commented, "The U.S. and Europe will remain the largest consumers of healthcare packaging as new sophisticated therapies with specialized packaging needs continue to be introduced. Surgical operations are also increasing due to a growing aging population, and with that comes the demand for more medical devices, which should strengthen the segment for the foreseeable future. TEQ's history of growth mirrors the growth in healthcare spending and medical device utilization, and we look forward to joining Sonoco in further expanding our capabilities to meet our customers' future needs."

Sonoco's acquisition of TEQ is subject to normal regulatory review and projected to be completed by the end of 2019. There are no planned changes in TEQ's leadership or customer relationships. The transaction is expected to be accretive to Sonoco's 2020 earnings, and TEQ's financial results will be reported within Sonoco's Consumer Packaging segment. |

SPE THERMOFORMING DIVISION'S SECOND ANNUAL STUDENT RC CAR RACE AND DESIGN COMPETITION HELD IN MILWAUKEE

Thirteen students from seven schools across the U.S. were charged with designing, manufacturing and decorating the bodies of radio-controlled cars whose chassis were furnished by the Division, with support from corporate sponsors. The car body had to be formed using clear plastic, such as PET, PETG, acrylic or polycarbonate, and produced using the vacuum/thermoforming process.

Students also participated in a race conducted on a built-to-specification indoor racetrack located on the exhibit hall floor during the Thermoforming Division's annual conference, held September 9-11 in Milwaukee, WI.

Cash prizes were awarded in three different categories: People's Choice, Best Design and the race itself. Zachary Veneziano and Ryan Messock of Kettering University won second place in the race behind Ryan Fuller of Georgia Tech.

The Kettering Bulldogs were sponsored by LyondellBasell.

Student participants were required to submit a technical paper that outlined the successes and challenges associated with the car design and manufacturing processes. Following is Zachary's and Ryan's report:

Design

The Kettering University SPE Student Chapter began the design process by first looking at which thermoformed bodies won in the inaugural year of the event.

Bodies that received praise from the judges had lots of small details that showcased the thermoforming process. A complex design led to a more complicated mold design, which was something that was kept in mind during the initial design phase. Chapter members were unsure of which manufacturing process would be used to create the mold. During discussions about the shell design, we agreed to make the shell look like an Audi R8. The reason for this decision was because a mold of this car body would have plenty of exterior details that would hopefully help in the design competition when the shells were judged on complexity and uniqueness.

We also hoped that designing a shell from an existing car body would attract the attention of the conference attendees who would recognize the car and win points

Pictured from left to right: Matt O'Hagan, SPE Thermoforming Division Student Activities Chair; Zachary Veneziano and Ryan Messock of the Kettering Bulldogs, Kettering University.

in the People's Choice Award. After the shell design was finalized, team members used Solidworks 3D modeling software to create a model of the mold.

Mold Manufacturing

The team brainstormed ways to quickly and inexpensively manufacture the tool. The original idea was to CNC the mold out of wood; this, however, proved costly compared to a 3D printed mold. It would also preserve as much detail. With a printed mold, detail in every axis could be present without requiring multi-axis CNC machines that would be needed if the mold had been made from wood.

The team worked with a 3D rapid prototyping company in Ann Arbor to ensure the CAD model was printed without any major issues. Next, a material was chosen that would work best for the project. Because the mold was going to have hot sheets of plastic formed over it, the decision was made that the print material should have as high a melting point as possible. The team selected ABS as the print material

since it has a melting point of approximately 400°F and the heated PETG that would be formed over it only has a melting point of 300°F.

The team thought that this temperature disparity would prevent warping of the plastic mold when the two plastics came in contact with each another. After the material was chosen, the final design was sent to the prototyping company. The print project took 68 hours to complete, and it resulted in a 5mm thick shell that would be used as the mold.

Forming

The Kettering University Mechanical Engineering Department owns and maintains a MAAC thermoforming machine, and it was used to form the RC car shell. The team placed the mold in the machine and began running trials in order to work out the kinks in the process, produce parts that looked good and preserved the details of the design. During this grooming process, several issues occurred that hindered the forming of good parts. The first issue was that the PETG sheet was allowed to heat for too long, resulting in significant sagging of the sheet. This resulted in the heated sheet running into the mold during the first trial, ruining the sheet. This issue was corrected by turning the temperature control down to reduce sagging. After this initial correction, the heated sheets were forming around the mold, but not sealing. In order to correct this, a plug was used that allowed for better sealing around the mold and for some adequate partsto be formed.

While the parts coming off of the machine maintained the details of the mold, webbing still occurred at the edges of the shells. This issue was only resolved after more temperature controls were adjusted, as well as heating times. When these were dialed in correctly, good parts were made that showed all of the details of the mold without any webbing or unwanted features.

Issues

During the grooming process, one major issue occurred that set the team back significantly. While conducting trial runs, the mold was left to sit next to the heater block for too long, which caused warping of the mold. When choosing ABS as the mold material, the meat of the PETG sheet was taken into consideration, but the heater blocks were not. The heater blocks were only an issue if the mold was allowed to sit directly next to them for extended periods of time; however, the damage to the mold was already done, so additional work was necessary. Bondo was used to reform the damaged back end of the mold, and after lots of sandpaper and buffing, the mold was smooth and worked as well as it had before the damage occurred.

Another issue that the team encountered was with the tires of the RC car hitting the overhanging wheel wells of the thermoformed body. This turned out to be a significant issue for the race, as the unintended rubbing hindered the steering of the car, which affected race performance. To overcome this issue, the team decided that it would be best to bring two bodies to the SPE Thermoforming Conference: one would act as a show body, and the other as a race body. The show body would be used to showcase the thermoformed details of the car, and the race body would be identical to the show body with the exception of the wheel wells, which were cut out to allow for a better turning radius. This solution proved simple yet effective, as only a few details were cut away in the race body and the cuts allowed for significantly better steering and handling of the RC car.

Thermoforming Competition Puts Innovation in Focus

By Bill Bregar, *Plastics News*

Milwaukee — Placon Corp. and Profile Plastics Inc. each picked up three awards, and Plastics Unlimited Inc. won the People's Choice award, during the parts competition at the Society of Plastics Engineers Thermoforming Conference.

Held Sept. 9-11, the conference drew 534 people to the Wisconsin Center in Milwaukee for technical presentations and a trade show. Parts competition winners were announced at an awards dinner Sept. 10.

Parts competition Chairman Travis Kieffer said 18 parts entered the competition. This year, the SPE thermoforming division added two new awards, for parts that show sustainability and the use of recycled materials, and parts made with automation and new technology, he said.

Kieffer is chief operating officer of Plastics Unlimited.

Roll-Fed Thin-Gauge, Gold

Placon of Madison, Wis., took home the gold for the Orthofix tray package designed to hold two medical screws in place until they are used in the operating room. Placon thermoforms the packaging, which includes a retainer tray and a tray cover, from glycol-modified PET sheet.

Placon officials said they allowed the customer to save more than $50,000 — the average cost to validate a new medical package. The key challenge was finding a package that would hold the screws without causing the coating of hydroxyapatite to rub off while in the package. HA coatings in each screw help reduce chances the screw will back out after implantation into the bone.

Roll-Fed Thin-Gauge, Silver

Placon also won silver in the category for a bi-fold, standup clamshell packaging for a padlock from Pacific Lock Co. that gives 100 percent more space for marketing graphics than a traditional clamshell, thanks to a back panel that can open and close. The PET package can hold each of five lock models.

Placon says that in most cases, this type of package would be injection molded. "However, with precision trim and tooling options here at Placon, we were able to design a

GN

Thermoforming Equipment

GN800

Form/Cut/Stack model

Are you still producing too much waste?

Do you want to reduce production costs?

If yes

contact us at

gn@gncanada.com

www.gncanada.com

more lightweight package that can be thermoformed in a single piece during production," officials said in the award information.

Roll-Fed Thin-Gauge Food, Gold

Lindar Corp. of Baxter, Minn., won the gold for the Simply Secure tamper-obvious hinged package, formed from black and clear amorphous PET sheet, for holding single-serve bakery items.

The criteria included a design that could utilize the customer's production automation, handle automated label application and hold the product in place even if tipped upside down. The design has a tapered closure from the hinge to the front opening tab to ship and display more product in less space. Lindar officials said tri registration and consistent perforations to remove the tamper-obvious closure from the 10-cavity aluminum tool presented significant tooling and production challenges.

Roll-Fed Thin-Gauge Food, Silver

Placon won silver for a modular, stacking polypropylene and microwavable foodservice package, the HomeFresh Entree. A vent channel was designed and located within the base of the containers to allow steam from hot foods to evacuate from the container when closed. The channel allows the air to circulate through the container compartments and escape through a c-vent on the lid.

The lid was made with a steel-rule-trim modular tooling. Key components such as anvils and c-cut blades could be shared, saving on tooling costs and reducing setup and changeover time. The vent is trimmed at the end of the forming cycle, inside the form tool and then opened by Placon-designed tooling in the stacker.

The PP container, which can be washed, heated and reused for additional meal leftovers, has a lid made from Placon's Ecostar material, a food-grade sheet made from post-consumer PET.

Roll-Fed Thin-Gauge Recycled/Sustainable

CMI Plastics Inc. of Ayden, N.C., won the category for a tray and lid for holding 15 different items in the Hoppe's Black brand of gun cleaning kit. The package doubles as long-term storage at home.

The challenge was to design a rigid thermoformed tray that has the appearance of a heavy-duty injection molded part. CMI forms the black tray from recycled ABS sheet from Impact Plastics. The sheet contains a minimum of 70 percent recycled content, CMI officials said. The clear lid is made with PET containing at least 50 percent recycled content.

Cut-Sheet Heavy-Gauge Vacuum Forming, Gold

Profile Plastics of Lake Bluff, Ill., picked up the gold for a neonatal intensive care unit, formed of cast acrylic sheet, to achieve total clarity on all flat surfaces so nurses can have complete, unimpeded visibility of premature newborns.

Profile determined that to meet the target price point, the part had to be molded in a rotary forming machine equipped with a quartz oven. The company also incorporated a precisely "shaded" section to hide the unit's electronics and wiring, which was accomplished using distortion printing of each sheet before forming. Five-axis, close-tolerance CNC trimming was done to precisely fit with mating parts.

Cut-Sheet Heavy-Gauge Vacuum Forming, Silver

SAY Plastics Inc. of McSherrystown, Pa., took home silver for a door assembly for a new generation of commercial tankless hot water heaters for use in places such as hotels.

According to SAY Plastics, the customer originally planned to buy fabricated steel doors from China, but urgent timing needs and a desire for a lightweight door with higher cosmetic features turned to SAY and thermoforming.

The tooling required was two single-cavity epoxy CNC machined molds and CNC machined trim and assembly fixtures. SAY shipped the first production in six weeks.

The assembly consists of five thermoformed parts made of custom color-matched Kydex 100 sheet. The inner panel provides sharp color contrast to accent the customer's name and logo through machined reliefs in the outer paid. The assembly also features a 3D printed mounting bracket for the touchscreen — done by SAY Plastics' in-house 3D printing department.

Recently, an aluminum mold was built to form the inner panel. The outer panel and hinge cover molds will remain in epoxy until the next phase of product design changes are completed, the company said. Also, the mounting bracket for the touchscreen has been switched over to injection molding.

Bill Bregar

Ray Products Co. Inc. won gold for the multipart and multiprocess enclosure for an industrial 3D printer.

Cut-Sheet Heavy-Gauge Pressure Forming, Gold

Ray Products Co. Inc. of Ontario, Calif., grabbed the gold for multipart and multi-process enclosure for an industrial Stratasys F Series 3D printer.

The initial design was intended for reaction injection molding, but once the customer understood the values and benefits of pressure forming, the design shifted to a 100 percent molded-in color, pressure-formed unit, according to Ray Products officials. Pressure forming allowed for making larger parts, reducing the total number of parts and tools needed. Also, paint was eliminated and all structural ribs were removed.

Only two bonded blocks are needed for the multipart assembly, by manufacturing the unit with pressure forming and using molded-in features and undercuts. Two large, deep undercuts into the drawers of the front of the housing was a significant challenge. A two-motion plug-assist was required the generate the double-undercut door handle.

Ray Products used Kydex T color-matched PVC-acrylic sheet and molded the parts on a Modern Machinery rotary pressure former. American Tool & Engineering Inc. built the aluminum tooling. Parts are trimming on Shape Process Automation six-axis robot routers.

Cut-Sheet Heavy-Gauge Pressure Forming, Silver

Profile Plastics picked up silver for a cover for a motor drive for control systems. Profile forms the part using Kydex T, then does two-tone painting. Detailed and crisp cosmetics were required.

Limited space for internal components required a smaller-than-normal radii around the perimeter of the part, providing a challenge for the specific fastener types used and also to maintain critical part thickness when making the part with a deep-draw ratio. Profile used a full-part perimeter undercut for proper mounting to the base unit as well as maximum thickness in specific areas.

Twin-Sheet Heavy-Gauge, Gold

Profile Plastics won gold for a clear lid for a beverage dispenser that replaced a part for hot-plate welded two injection molded parts. Those earlier parts failed due to crazing.

The twin-sheet process was picked to meet part specifications of a 100 percent leakproof seal, dishwasher safe, impact resistance and optical clarity.

Profile Plastics forms the lid from PETG sheet.

Kal Plastics won the gold for a vacuum-formed TPO truck camper, cab-over front cap.

robotically trimmed and then assembled using vision systems and augmented work instructions to ensure a complete and correct assembly.

The assembly has 88 components and 28 steps prior to shipment. Assembly operators are guided by augmented work instructions projected onto the surface of the part.

Bill Bregar

Cut-Sheet Heavy-Gauge TPO, Gold

Los Angeles-based Kal Plastics won the gold for a vacuum-formed TPO truck camper, cab-over front cap for hauling behind a pickup truck. The customer made the move to reduce costly field repairs and warranty claims on an earlier glass-reinforced plastic camper and to reduce overall weight of the camper, Kal officials said.

The customer identified the front, curved surface to be most critical area of the part. Kal Plastics designed to make the mold in two cast-aluminum sections, allowing the flexibility to work out any imperfections in the finished mold. Another feature was the placement of thermal cooling system and the bracing of the mold.

Cut-Sheet Heavy-Gauge Parts Produced with Automation and New Technology, Gold

Wilbert Plastic Services Inc., based in Belmont, N.C., won the gold for a medical equipment enclosure that is formed

People's Choice

Plastics Unlimited of Preston, Iowa, won the People's Choice Award for a roof for a tractor cab, made of two thermoformed parts that are glued together.

The customer approached Plastics Unlimited about producing a cab room top that would incorporate mounting brackets and air ducts, with a color-matched Class A top side with a black textured bottom side — while keeping tooling costs low.

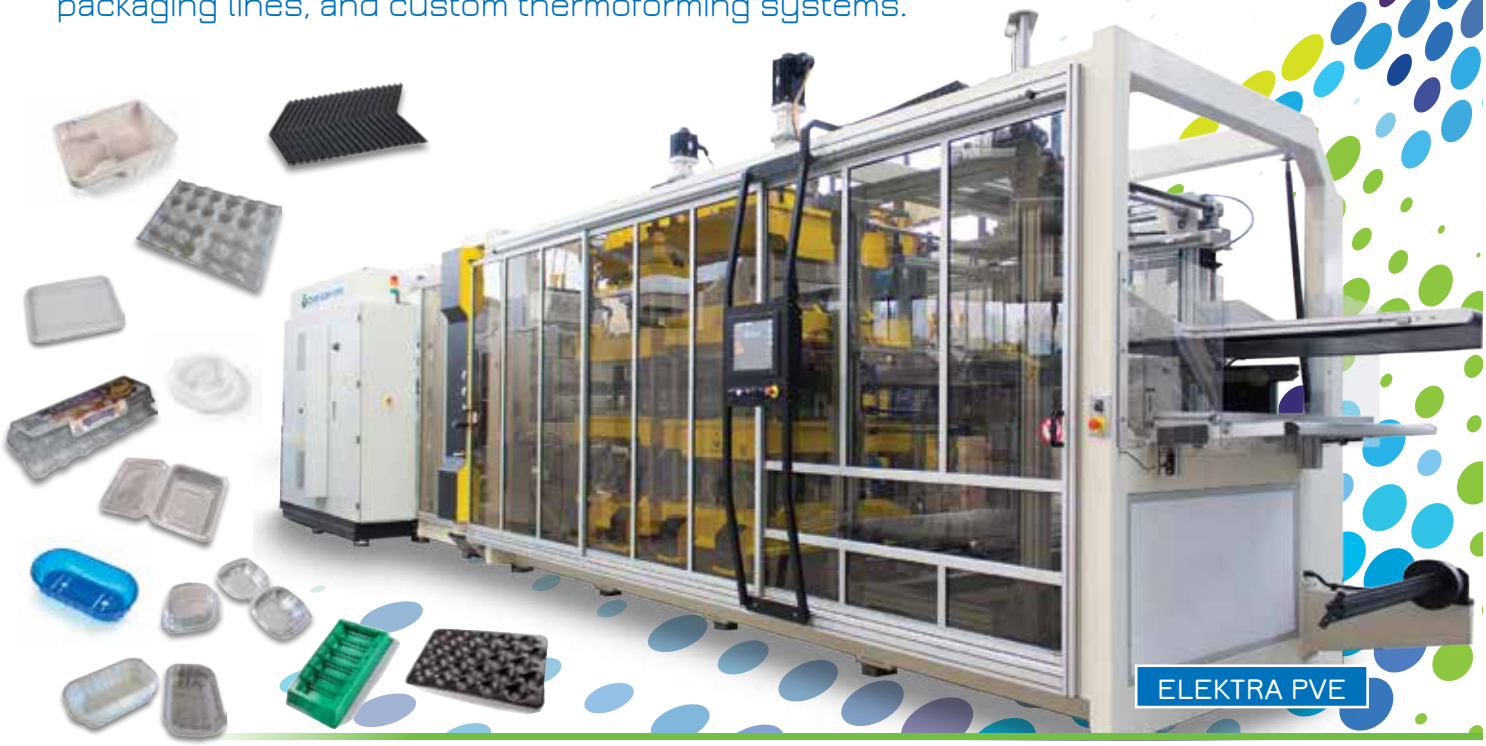
The outside material is a high-gloss acrylic capped ABS. The bottom side is black acrylic-capped ABS with a haircell finish. One challenge is controlling the shrink and making sure both sides fit correctly so the glue gap is consistent. Company officials said the two-sheet glued design was a huge tooling cost savings over other processes like long-fiber injection molding, sheet molding compound, injection molding or twin-sheet molded plastics. |

OMG
THERMOFORMING

kreativitylab.it

Since 1965, our mission:
The design and manufacture of the most advanced and energy efficient thermoforming machines in the world, for the processing of thermoplastic materials.

O.M.G. srl currently offers a wide variety of standard series machines for both thin and heavy gauge applications, as well as highly customized complete packaging lines, and custom thermoforming systems.



ENERGY EFFICIENT, ALL ELECTRIC SERVO DRIVE MOVEMENTS

From large to small size inline machines, Cut-in-place machines, to custom thermoforming lines and systems for the processing of all types of thermo-formable plastics, including PET, PLA, PS, PP,EVOH, OPS, HIPS, EPS, PE, PVC, PC, PE, HDPE and many more....

O.M.G. can provide a cost effective solution for your everyday challenges!!

OPTIONS:

Edge preheater system, drum pre-heaters for running PP, material grinders, cut-in-place presses, punch & die presses, additional modules for after the press automation, single or double sided A/B stacking robots, complete tooling packages and much more...

Call O.M.G. for all your thermoforming application needs!!

Italian Experience & Technology in the world

O.M.G. srl - ITALY
10040 Givoletto (To)
Tel. +39 (011) 9947156
info@omgitaly.com

O.M.G. USA
Paxton, Ma 01612
Tel. +1 (508) 7521457
pietro.caiani@omgusa.net

O.M.G.: your next thermoforming machine! **WWW.OMGITALY.COM**

Manufacturing Efficiency: Lessons From a PhD-Grade Industrial Energy Audit

By Jason Middleton, VP Sales, Ray Products, Ontario, CA

In the United States, about one-third of our energy is used for industrial purposes. The good news is that today, industrial energy usage is more efficient than ever before. Over the past 30 years, the amount of energy used to produce $1 worth of goods has been cut in half.

Still, there's room for improvement. And whether you're a manufacturer who's looking to save the planet or cut your monthly energy bill, efficiency is worth looking into.

Last fall, a group of PhDs, grad students and professionals from San Diego State University's Industrial Assessment Center descended on our plastic manufacturing plant in Ontario, California. They spent a day poking around our facility, making observations, and taking measurements and notes. They then left with a stack of data to process.

In February, they delivered a 52-page master report to my inbox, complete with their findings and recommendations for improvements. The bottom line was that even in a relatively efficient facility, they found opportunities to reduce our energy consumption in ways that could save an estimated $17K in annual energy and maintenance costs.

Not every manufacturing facility has access to a team of PhDs from SDSU. So, I thought I'd share our report's key findings that could be broadly applicable to other manufacturing facilities.

A Head Start: Some Ways in Which We Were Already Efficient

Our facility had several efficiency advantages to build on. We're a heavy-gauge thermoformer that just celebrated our 70th anniversary. When we moved into our current plant in 1995, it was purpose-built for our needs, and we had 46 years of experience to build on.

As a result, we were able to build a plant that was very efficient from the get-go. Our layout is optimized to minimize material transport and distance traveled, as well as maximize venting; it also allows for as much process efficiency as possible. Our more recent investments in automation, robotics and other new technologies have enabled us to further improve that efficiency while adding new services to our plant.

Beyond these base-level efficiencies, our SDSU assessment also called out the efficient use of lighting and reflectors, organization and layout, and focus on safety — which result in process and energy efficiency.

But, even with these efficiencies already in place, we still found plenty of room for efficiency advancements.

Lighting: Rapid Advancements in Efficiency

We're not new to energy-efficient lighting. About a decade ago, we replaced our old HID lighting with (then) stateof-the-art high-efficiency T8 fluorescent lighting. But, LED lighting technology has matured significantly since then. Our SDSU engineers estimated that, by retrofitting our existing fluorescent fixtures with LED lighting, we could move from 175 watts per fixture to 90 watts per fixture.

In their estimation, that retrofit could save our facility nearly $8K per year in combined energy and maintenance savings, and be implemented with a cost of just under $10K.

That's a deal that I think any facility would take. With our assessment's math, the upgrade would pay for itself in a little over a year. So, we decided to move ahead with their recommendations.

That's when we ran into a bit of a challenge. While our SDSU team had believed that we could keep our existing fluorescent fixtures and use a retrofit kit to convert them into LEDs, the lighting contractors whom we talked to found that our specific fixtures weren't compatible with retrofit kits.

As a result, our upgrade would need to completely replace our existing fixtures, which increased the combined labor and lighting cost by a factor of 3–4x.

This made us change strategy just a bit. We're still planning to upgrade our fluorescent lighting to more efficient LEDs, but instead of performing the upgrade immediately, we're going to hold off for a bit. As our fluorescent lighting nears its expected end of life and maintenance costs climb over the coming years, we'll see a higher ROI from a wholesale replacement. It's also likely that in that time, LED efficiency will continue to increase while costs come down.

Follow the SPE Thermoforming Division on Twitter @SPEThermo

Instead of relamping our fluorescent fixtures when that time comes, we'll roll those costs into their wholesale LED replacement.

In the meantime, we've followed the study's other lighting-related recommendation: installing occupancy sensors throughout much of our facility. There's no more efficient light than one that's turned off, and these sensors will help to ensure that we're not burning energy to illuminate unoccupied parts of our facility.

Key Lighting Takeaways

Even if you've invested in energy-efficient lighting in the past, it's likely that newer, more efficient lighting technologies and intelligent lighting controls are available today. Work with your utility or a qualified lighting contractor to assess the cost and benefits of a lighting upgrade.

Machinery: The Benefits of Premium-Efficiency Motors

Electric motors account for about 40% of all energy consumption in the U.S. In 2016, the Department of Energy launched new "NEMA Premium" efficiency standards for electric motors.

While the savings of a premium-efficiency motor vary with load and operating hours, replacing a single 100horsepower standard motor with a premium-efficiency motor could generate nearly $3,000 in annual energy savings.

We use a range of electric motors in our manufacturing operations, with ratings of between 3 hp and 100 hp. Our SDSU assessment estimated annual energy savings of about $3,800 if we replace them all with premium efficiency motors.

The SDSU assessment recommended that we wait until the existing motors are due for replacement to perform this upgrade. If we consider the total cost of just going in today, ripping out our functioning standard-efficiency motors and putting in premium-efficiency replacements, it would take a decade or more to pay for that upgrade.

By timing our upgrades to coincide with the timing of motor replacements, the cost of this efficiency upgrade is simply the cost of a premium-efficiency motor, minus the cost of a standard-efficiency motor.

With that plan of action, our assessment estimated that our premium-efficiency motor upgrades would pay for themselves with energy savings in about 2.5 years.

Key Machinery Takeaways

Assess the efficiency of your existing motors. If they're standard-efficiency or the older "NEMA Energy Efficient" designation, plan to replace them with premium-efficiency models at your normal replacement interval, or when you experience issues with your current equipment.

Compressed Air: More Efficient Production, Use and Storage

The U.S. Department of Energy estimates that compressed air systems account for 10% of the energy used in this country's manufacturing. Our facility uses a 100 hp compressor (with another for backup) to power pneumatic drills, sanders, grinders and blow guns used throughout our manufacturing processes.

Our SDSU assessment made four recommendations related to improving the efficiency of our compressed air system. We'll be following two of those recommendations and bypassing the other two.

Leak Reduction

Anyone who's worked with compressed air systems knows that leaks happen. Even high-quality fittings and bearings degrade over time and need to be sealed, maintained and replaced at regular intervals.

Our SDSU assessment estimated our energy costs for leaked air at a bit over $600 per year. Not a huge amount, but certainly an issue worth addressing.

It's challenging to detect air leaks in a noisy production environment. So, on a recent Saturday morning, a team of us went into the now-quiet factory, filled up the compressed air lines, and spent a few hours finding and fixing leaks. We've also added this as a process on our regular maintenance schedule so that we can keep ahead of compressed air leaks going forward.

Reducing Maximum Air Settings

Our air compressor is set to maintain 110 psi, while none of the equipment that it runs requires more than 100 psi. This gives us a little bit of headroom so that if there's a temporary spike in demand, our system pressure never dips below that 100 psi mark.

In our application, a temporary dip in pressure could result in a failed part. That's something we work hard to avoid.

However, our SDSU assessment estimated that just dropping the max pressure of our system to 100 psi could save a bit over $1,000 per year in energy costs.

So, we've started to look at other solutions to maintain that headroom, with a slightly lower pressure. We haven't completed the implementation process, but we're moving toward adding a reserve pressure tank to our system. That will allow us to maintain pressure over spikes in demand, while earning the energy-savings benefits of an overall slightly lower system pressure.

Recommendations We Didn't Take: Switching to Electric Tools and Brooms

Our report gave two recommendations that made sense on paper, but not for our production process.

First, the report recommended that we switch from air-powered to electric tools. Our experience is that electric tools simply can't keep up with the power and durability of pneumatic tools in our environment. The estimated $2,400 in annual electric savings won't make up for the loss of performance and durability.

The report also recommended that instead of having our workers clean off products, equipment and work areas with air guns, we provide them with brooms to perform the same task. In our opinion, the $1,30 in estimated savings isn't worth the decreases in productivity and worker satisfaction.

Our Results

In all, our audit from SDSU found just over $17K in potential energy savings, with about $22K in improvement costs. The reality of our lighting options changed that math a bit, but by rolling in some maintenance costs and implementing the auditors' recommendations over time, we expect that we'll eventually see about $10K in energy savings, with an improvement cost that's not too far off their initial estimates.

For a large-scale manufacturing operation like ours, that may not seem like huge savings, but over time — say, a period of three, five or 10 years — I can certainly think of things that I'd rather do with $30,000, $50,000 or $100,000 than just feed it back to the electric company.

Tools for Building Efficiency in Your Plant

While not every manufacturing plant has access to the same PhD-level audit that we did, you still have plenty of tools for increasing efficiency.

Here's a list of resources that I'd recommend for finding and improving efficiency:

Lighting Contractor Association Searches

Our biggest energy-savings opportunity was in improving the efficiency of our lighting. There are two national organizations that focus on certification and training in this area: the National Electrical Contractors Association (NECA) and the National Association of Lighting Management Companies (NALMCO). NALMCO is smaller but more focused on lighting, while NECA is larger but allows you to search for contractors who specialize in lighting or efficiency.
http://nalmco.org
http://www.necaconnection.org/#/search/

Energy Star's Industrial Energy Management Tools

Energy Star, the government's energy-efficiency program, offers a range of specific tools targeted at manufacturers. These can range from certifications and recognition to tools, rebates and incentives.
https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants

Energy.gov Industrial Assessment Centers

Our SDSU audit came out of a government program that funds Industrial Assessment Centers (IACs) at schools across the country. You can check to see if there's an IAC near you that could perform the same type of audit that we had, and find relevant data from audits like ours performed at a variety of industrial facilities around the country.
https://www.energy.gov/eere/amo/industrial-assessment-centers-iacs

Your Utility

Electrical utilities are typically required, by law, to operate energy-efficiency programs. Many times, these rebates can pay for part or even all of the upgrade costs of new efficiency measures. It's definitely worth reaching out to your utility to see what programs and incentives they offer that might be applicable to your facility.

Committed to Smarter Practices We may have been in business for over 70 years, but that doesn't make us old-school. Every item Ray Products produces is created in an efficient, state-of-the-art thermoforming facility, and we plan to keep it that way. As technologies progress to make manufacturing plants and equipment more efficient, you can rest assured that we will too. It's simply good sense. |

Multilayer EVOH/PP Packaging in Processing and Performance of Recycled PP

Didier Houssier, Geert Herremans, Kuraray, EVAL N.V., Antwerp, Belgium
Edward Kosior, Dr Jon Mitchell, Kelvin Davies, Nextek Ltd. London, UK & Melbourne, Australia

Abstract

Kuraray, EVAL Europe N.V. (EE) produces Ethylene Vinyl Alcohol copolymers (EVAL™), which are used in multilayer structures in a combination with a wide range of materials such as Polypropylene (PP) to produce multilayer trays, pots, or capsules to provide superior barrier properties to gases, flavours or bring functional barriers against external contaminants such as mineral oils (MOSH, MOAH). Such trays are typically made by co-extrusion technology followed by thermoforming in-line or off-line, and are used for food packaging such as coffee, ready meals, and other packaging applications for sauces, fruit salads, or for the packaging of medical products for which the water barrier of PP is of added value.

The objective of the study was to investigate if multilayer EVOH/PP rigid packaging material, which is a percentage of the post-consumer recycling stream, can be effectively sorted with the PP stream and decontaminated back to food grade approved for use as Post-Consumer Recycled (PCR)-PP into food packaging applications.

Multilayer rigid food packaging found in the post-consumer recycling stream has been represented in the design of materials guides and recycling guides as 'may be suitable' for recycling. The present work investigates the recyclability of EVOH barrier packaging due to the growing trends of multilayer rigid food packaging and more importantly, as recovery systems strive towards a better circular economy.

The steps taken to produce food grade post-consumer recycled PP (rPP) with analysis included: audits of the PP fraction at Systec Plastics GmbH; testing on automated NIR sorting equipment at Tomra (Titech); compounding in a low pressure, elevated temperature, food-grade decontamination process and overall migration testing conducted by Smithers-Pira.

The evaluation showed that rPP material containing at least 0.5% EVOH (equivalent to 10% multilayer EVOH/PP packaging) can be "super cleaned" to food grade quality without any significant impact on the process performance or physical properties compared to rPP only. The results showed that at the levels of multilayer EVOH packaging typically found in the recycled PP stream, the rPP can be processed and utilized in a full range of applications, without impact on migration characteristics or physical properties compared to rPP alone.

Introduction

Food packaging has seen significant changes over recent decades with demand for pre-packaged food increasing, hence the requirement for research and development in barrier and shelf life-extending materials. In many cases, it is not possible to meet the packaging requirements using one single material and the benefit of multilayer structures stands in taking the best of the performances of each resin entering in the structure. [1][2]

Packaging must comply with food safety regulations to protect the consumer, therefore multilayer structures are essential in preserving and protecting the food. In certain cases, packaging provides a barrier to gas permeation because of the risk of microbial activity and food spoilage. In other cases, functional barriers help to keep the food away from external contaminants. In Europe, Plastics Regulation (EU) No 10/2011 defines layer B as a "functional barrier" if it reduces the level of migration of a substance from layer A to layer C to a level where it can meet regulatory limits. While European regulation does not yet specifically allow the use of a functional barrier for recycled plastics, Section VII from the Food and Drug Administration (FDA) 'Guidance for Industry: Use of Recycled Plastics in Food Packaging: Chemistry Considerations,' defines the use of an effective barrier.[1][3]

Kuraray is a world leader in EVOH (ethylene vinyl-alcohol copolymers) production and technology. An EVAL™ layer thickness of only a few microns helps avoid spoilage by keeping oxygen and odours out, while locking flavours, aromas and modified atmosphere inside the package. This

prolongs shelf life and reduces the need for artificial additives to be added into food. Fewer resources can often be used for the same packaging function. Optimized portion size, light weight and extended freshness help improve the efficiency of storage, transport and display, saving costs and preserving resources. Kuraray quotes that an EVALTM layer of just a few microns is enough to provide an amazingly effective gas and aroma barrier, to protect the quality of packaged goods.[4]

EVOH will continue to be used in packaging for these reasons and ideally would be recycled with minimal detrimental effects in the polyolefin industry. It is well known that EVOH offers great barrier protection against oxygen, odours and gases. However, for EVOH to perform at its best and to address its sensitivity to moisture in humid conditions, multilayer structures are needed.

Kuraray, EVAL Europe N.V. produces Ethylene Vinyl Alcohol copolymer (EVOH) which is used in thermoformed PP multilayer trays to provide gas barrier properties for coffee, ready meal or fruit salads. Producers or holders of plastic waste or polymeric textile waste are offering various materials from post-industrial or post-consumer origin. Clean rPP grades are produced in Belgium where an advance collection system can be found, and in other countries, primarily from production waste and from packaging such as bags/covers, film, sheets (thermoformed), white monolayer or coloured trays, that can be re-used for manufacture of new non-food applications because of the legal frame for food contact packaging application but still providing a loop recycling of this material. Food grade rPP from mechanical recycling is not a commercial material currently available from suppliers, but it will be available from an additional number of recyclers in the near future. [5] Development of chemical recycling technologies is another way which is progressing well, opening business opportunities for food contact or cosmetic packaging applications.

For PP, the recyclability characterization in the recoup guidance of core principles for plastic packaging recyclability states that EVOH may be suitable for recycling for some applications. No specific percentage restriction is specified requiring testing of the structures placed onto the market. [6]

Similarly, the French organization Cotrep has issued recommendations for packaging guidelines which state that EVOH in multilayer structures can be used also without specific restrictions.[7]

Institute Cyclos-HTP (Germany), in its January 2019 publication on verification and examination of recyclability, classifies the EVOH barrier layer as "Category 2": "Materials, not separable by the treatment steps established in the recycling process, having no or negligible impact on the recyclate properties up to a defined relevant concentration". [8]

Such absence of (strict) constraints enables manufacturers of EVOH to participate in the circular economy with growing pressures on recycling and follows the outcome of in-depth studies conducted by every actor of the value chain from raw material producers to the recyclers.

Kuraray, EVAL Europe N.V. wanted to investigate in detail that multilayer natural coloured PP/EVOH material can be effectively recycled as a percentage of the post-consumer stream and used back into food packaging and applications. Nextek assisted with conducting this study and trials and evaluation of the recycling process with thermoformed multilayer PP barrier trays. Food grade rPP recycling involves sorting that removes colored PP, although some white is often retained. The performance of EVOH was also assessed during the food grade decontamination or super cleaning stage to confirm that the presence of EVOH does not negatively impact on the process or the properties of the final food grade material.

Market Applications and Percentage of EVOH in Recycling Streams

An assessment was made based on available market data and material audits to establish a typical and maximum percentage of PP barrier packaging in the market.

Nextek and Kuraray attended the Systec Plastics recycling facility in Germany to participate in an audit of a sorted PP bale to determine the level of multilayer PP packaging that could be identified. Bales of material that had been identified by NIR sorting as PP were sampled and hand sorted, visually looking for a range of packages that might be multilayer PP/EVOH packaging based on their labelling and the product type.

It is understandable that such material audit could only be conducted for a relatively small sample and this provides only a snapshot of the composition of the recycled PP stream.

Volumes and Applications of EVOH in the Market

In Europe, 10MM tons of PP are converted, accounting for about one-fifth of the plastic market. About one-third is used for packaging applications.

In France, rigid containers such as pots and trays are used for a wide variety of food products. These packages represent approximately 370,000 tons of waste per year, They can be in PET, HDPE, PP, PS, PVC. [9]

Using data from "Plastic Packaging Composition 2011" Wrap report, 556,000 tons (32%) of the UK consumer packaging market are trays (PTTs: Pots, tubs and trays), and 123,000 tons (22%) of trays are PP. PP is used for 15% of UK plastic packaging, both consumer and industrial plastic packaging. The largest growth in plastic packaging format appears to have been in PTTs from 2003 to 2013. [10] The large majority of this volume estimated is for monolayer PP packaging used for margarine, dairy products, vending cups or frozen foods.

It is difficult to acquire quantitative data on the volume of rigid multilayer barrier PP/EVOH packaging. The segment is relatively small and so is not usually differentiated in any way and is included in much broader and larger volume categories for rigid PP.

In the European market, from expert visits to supermarkets, it can be estimated that about 10% of the PTTs are rigid packs requiring an EVOH barrier for demanding applications such as coffee capsules, ready meal or baby food packaging. Based on a 5% by weight composition of EVOH highest ratio used in practice in such packaging, this represents about 200,000 tons of multilayer PP/EVOH/PP rigid packaging corresponding to 10000MT of EVOH, a volume that gives a good order of magnitude or an overestimate of the EVOH consumed in this market segment.

At the audit, meat trays made up the majority of the multilayer structures. Some drinkable coffee pots were also isolated but later identified as monolayer. From this small sample it was determined that approximately 2% of the rigid PP fraction was EVOH multilayer. Applying the same calculation as above, the corresponding amount of EVOH use for barrier rigid packaging at 5% by weight composition gives 4000MT of EVOH.

Finally, other work conducted at Greendot in which almost 600kg of rigid PP from seven different lots was audited and found to have from 1.2% - 12% with an average of 3.5% of packaging that was possibly EVOH multilayer material. The separated packaging was not further tested to confirm if they were in fact multilayer so that this result represents the highest possible level, with the actual presence of EVOH multilayer likely to be slightly less.

Using the calculation result from the market data of 10%, and the actual audit data of 2-3.5%, the assumption made by the project to use a 10% blend of PP/EVOH (5%) material is validated as representing a highest likely but realistic concentration of EVOH to be found in postconsumer recycling materials.

Experimental

An additional 10% multilayer post-industrial materials collected from various European converters with a nominal structure of PP//EVOH (5%)//PP was selected to represent a maximum peak percentage of multilayer material that might be found in the recycle stream. At these additional rates, with a PP//EVOH (5%)//PP structure, the actual EVOH content was 0.5% in the melt blend.

Post-consumer natural coloured PP that had been decontaminated and processed to pellets suitable for food grade (45kg) were available from Nextek and this was dry blended with granulated post-industrial trim from multilayer extrusion and thermoforming (5kg). The blend was then compounded together on a twin screw extruder to produce a pellet containing approximately 0.5% EVOH.

Compounding of the dry blend was conducted on a 26mm co-rotating twin screw extruder at 240°C with an average residence time of less than 3 minutes to produce a pelletized material.

The compounding trial was conducted at Millmerran research and manufacturing facility in the UK, a polymer engineering specialist in process and product development.

The pelletized PP compound was sent to Starlinger for decontaminating on a pilot scale Viscotec unit in the Starlinger laboratory. The PCR-PP and EVOH trim

compound was processed under high vacuum for 6 hours at 140oC to remove volatiles and provide a material suitable for food grade applications.

Material was then sent to EVAL Europe N.V. facilities in Antwerp for extrusion and thermoforming trials.

For migration studies, SMITHERS PIRA recommended using iso-octane simulant at 40°C for 24 hours, accordance with EU regulation No 10/2011 and tested in accordance with EN 1186-15 rapid extraction test. The test was carried out by filling the cups with the simulant, testing was done in triplicate.

For physical testing Tensile testing was conducted by EVAL Europe N.V., Impact testing and Density measurements were conducted by Nextek.

Results

Automated Sorting Trials

Kuraray provided 28 samples of a range of multilayer EVOH/PP trays, from various types of foods rice, pet food, soup or baby food applications, with the layer of EVOH ranging from 3.8-14.5%. The trays were sent to Tomra Sorting Solutions using Titech autosort technology to establish if their NIR detection system was able to detect the presence of EVOH or any other variation that would distinguish them from monolayer PP articles.

Tomra assessed the containers including labels and lids, which can influence identification. In all cases, the PP/EVOH PTTs were detected as PP (unless a non PP label was applied), which would conventionally be sorted to a PP fraction in most Materials Recycling Factories (MRFs). Tomra concluded that it was not possible to identify a difference between the spectra of PP and PP/EVOH/PP.

It should also be noted that as with other packaging, unless the labels are removed prior to sorting, trays, tubs or pots are often miss-identified and sorted according to the label material, such as PET, LDPE or even PVC. The presence of a non-PP lid remaining on the open package can potentially be a contamination risk of the recycling stream, especially when it uses Aluminium or BO-PET.

These results confirm that multilayer PP/EVOH PTTs would most typically be identified as PP and be sorted by NIR based automatic sorting systems, which are used in MRFs and Polymer RFs around the world, into the PP stream with monolayer PP packaging containers. Typically, the PP packaging materials are further sorted based on color to isolate the higher value natural PP fraction. A significant amount of multilayer PP/EVOH are not colored and will be separated during the sorting process.

The beauty of fine finishes. The flexibility of laminate. Combined, the perfect blend of form and function.

Innovative Laminations offers hundreds of custom, decorative plastic solutions for your next thermoforming application. We manufacture according to your specifications and provide the highest quality, most durable product available, at a very competitive price.

Contact us today and we'll help guide you through the many options available for your design project.

ILC
INNOVATIVE LAMINATIONS
COMPANY, INC
A trotec COMPANY

252.745.8133
www.innovative-laminations.com
ISO 9001:2015 Registered Co.

Manual Sorting Bale Audit at Recycling Facilities

A manual audit of the PP fraction at Der Grûne Punkt Cologne DE (Greendot) and at Systec Plastics recycling facility in Hörstel DE took place to determine the level of multilayer PP packaging that could be identified. A bale of material that had been identified by NIR sorting as PP was hand sorted and visually inspected by expert eyes for articles that may be multilayer EVOH/PP, based on their labelling, the shape of the packaging and the food type.

From seven sample lots the following materials types were identified: Meat packages, Pate (Processed meat), Fish Salad, Curry sausages, Snack to go, Ready Meal, Fruit Bowl and Cat Food.

Figure 1: PP packaging found in post-consumer recycling stream

Meat trays made up the majority of the multilayer; some drinkable coffee pots were also isolated but later identified as monolayer. From this small sample it was determined that approximately 2% of the rigid PP fraction was EVOH multilayer. These were sent to EVAL Europe N.V. laboratory for cross-section analysis, As expected the majority of the sample (80%) of the PP fraction were monolayer, natural color or white sandy appearance.

Other work conducted at Greendot in which almost 600kg of rigid PP from seven different lots was audited and found to have from 1.2% - 12% with an average of 3.5% of packaging that was possibly EVOH multilayer material. The separated packaging was not further tested to confirm if they were in fact multilayer so that this result represents the highest possible level, with the actual presence of EVOH multilayer likely to be slightly less.

Figure 2: (potentially) EVOH multilayer PP packaging found in post-consumer recycling stream

Using the calculation result from the market data of 10%, and the actual audit data of 1.7-11.0%, the assumption made by the project to use a 10% blend of PP/EVOH (5%) material is validated as representing a highest likely concentration of EVOH to be found in postconsumer recycling materials.

Compounding Trials

Post-consumer natural coloured PP that had been decontaminated and processed to pellets suitable for food grade (45kg) were available from Nextek and this was dry blended with granulated post-Industrial trim from multilayer extrusion and thermoforming (5kg). The blend was then compounded together on a twin screw extruder to produce a pellet containing approximately 0.5% EVOH.

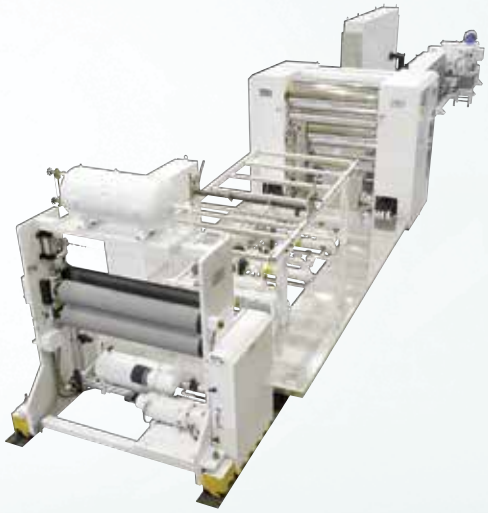
ADVANCED EXTRUDER TECHNOLOGIES

Design | Engineering | Manufacturing

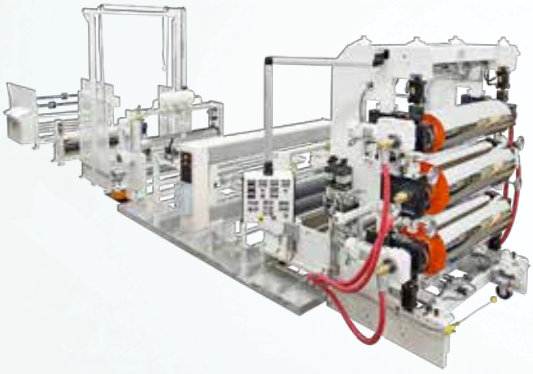
COMMITMENT TO EXCELLENCE
MADE IN THE U.S.A.

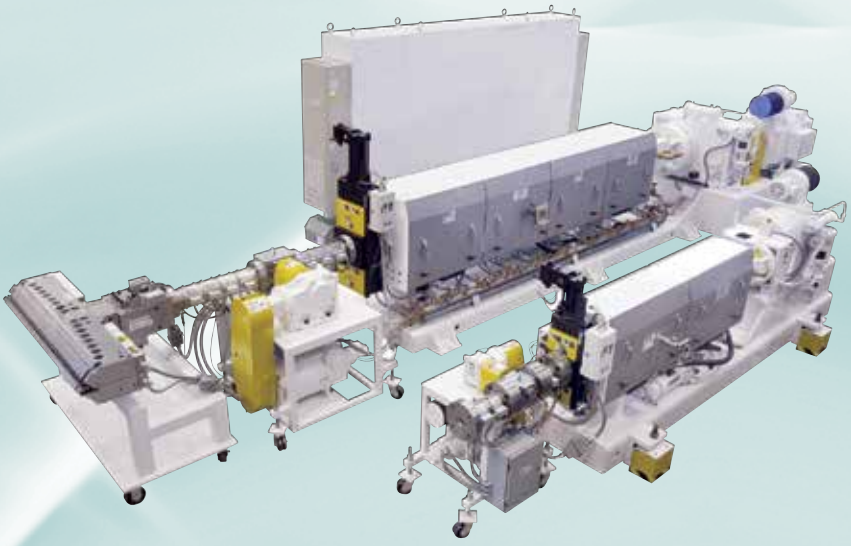
CUSTOM, SHEET EXTRUSION SYSTEM

DRYER-LESS, PET / PLA SHEET EXTRUSION SYSTEM



- High Performance
- Low Melt Temperature
- Short Dwell Time
- Excellent Mixing
- Low Energy Consumption
- High Vacuum System
- In-line IV Monitoring/Control System
- Compact Design
- Robust Design
- FDA Approved





- Mono Layer- Barrier Co Extrusion
- Thin Gauge – Heavy Gauge
- Extruder Size: 1.5”- 15” In Screw Dia.
- Quick Roll Change Design
- Custom Configuration
- Servo Driven
- Independently Driven
- Roll Diameter: 12”- 40”
- Face Width: 36”- 150”
- State-of-the-Art HMI Control System
- Unparallel Customer Service & Support
- Technology Driven

AET ADVANCED EXTRUDER TECHNOLOGIES, INC.
Commitment to Excellence

2281 East Devon, Elk Grove village IL. 60007 Tel: 847-238-9651 Fax: 847-238-9654 www aetextruder.com

The compounding trial was conducted at Millmerran research and manufacturing facility in the UK who are polymer engineering specialists in process and product development.

A high speed mixer was used to blend the PCR-PP and of multilayer PP/EVOH/PP regrind from EVAL Europe's customers to produce a 90:10 dry blend.

Figure 3: Labtech high Speed mixer for dry blending PCR-PP and PP/EVOH/PP multilayer scraps.

Compounding of the dry blend was conducted on a 26mm co-rotating twin screw extruder at 240°C with an average residence time of less than 3 minutes to produce a pelletized material.

Figure 4: Twin screw extruder for compounding and pelletizing the PCR-PP and EVOH blend

Figure 5: Melt blending and pelletizing of (left)rPP+PP/EVOH Blend and (right) rPP.

Decontamination of the Blended Material

The pelletized rPP compounds were sent to Starlinger for decontaminating on a pilot scale Viscotec unit in the Starlinger laboratory. The blend of PCR-PP and PP/EVOH/PP trim compound was processed under high vacuum for 6 hours at 140°C to remove volatiles and provide a material suitable for food grade applications.

This step is important to demonstrate that EVOH present in the multilayer PP/EVOH/PP regrind is also passing through the decontamination step.

Material was then sent to EVAL Europe facilities in Antwerp for extrusion and thermoforming trials under the attendance of Nextek.

(Co-)Extrusion Sheet Trials

The PCR-PP,EVOH compound was extruded into sheet and thermoformed to evaluate processing and visual properties of the decontaminated material. Sheet and formed containers were also used for migration studies to compare the performance of the PCR- PP/EVOH blend with food grade PCR-PP and virgin materials.

A range number of sheet product were made with the PCR-PP,EVOH compound blended with virgin PP and white masterbatch and different process condition that are summarized in the tables below.

Sample	Material	Screen-pack	Thickness (µm)	Remark
006-01	Regrind	No	+/- 1600	100% PCR-PP,EVOH
006-02	Blend 1	No	+/- 1600	50% PCR-PP,EVOH + 50% Moplen RP220M
006-03	Blend 2	100/100	+/- 800	25% PCR-PP,EVOH + 75% Moplen RP220M
006-04	Blend 1	100/100	+/- 800	50% PCR-PP,EVOH + 50% Moplen RP220M
006-05	Blend 2	50/100/325/ 100/50	+/- 800	25% PCR-PP,EVOH + 75% Moplen RP220M
006-06	Blend 3	50/100/325/ 100/50	+/- 800	(25% PCR-PP,EVOH + 75% Moplen RP220M) + 2.5% MB white
006-07	Blend 4	50/100/325/ 100/50	+/- 800	(50% PCR-PP,EVOH + 50% Moplen RP220M) + 2.5% MB white

Table 1: Summary of sheet extrusion trial products and conditions

LOW FLEX™ FORMER SERIES

- *LF5.0 Shown – 190 Ton*
- *Numerous quick change features*
- *Easy maintenance access*

LINEAR RAIL TRIM PRESS

- *LR5 Shown - 45 Ton*
- *Side Loading of Tool*
- *Numerous quick change features*
- *Precise tolerances via linear rails*

TECHNOLOGY

Flat Bed Formers
Form-Trim Models
Linear Trim Presses
Linear Vertical Press
Heavy Duty Presses
Tilt Bed (IML)
Linear Pre-Punch
Linear Scoring Station
Rotary Drum Former

PROCESSES

- PP, PET, HIPS, OPS
- PLA, HDPE, PS Foam
- In line/Roll Fed
- Cups, Car Cups, Lids
- Retort Products
- Tamper Evident
- Hinged Trays
-Storage contianers
-TIML

VALUE

- Energy Efficient
- Production Rates
- Move Times
- Ease of Access
- Reliability

SERVICE

- Training Classes
- On line help
- Process Training
- After hours help
- Included start up service

tslusa.biz

DAVIS-STANDARD®

davis-standard.com

Extruder Parameters		Temperatures °C,						Motor	Melt Pressure
Test n°	Screw Speed (rpm)	Z1	Z2	Z3	Z4	Adapter	Die	(A)	(bar)
1	123	225	235	240	240	240	240	2.8	8
2	100	180	210	210	210	210	210	3.2	61
3	150	180	210	220	220	220	220	3.9	197
Sheet Line	Thickness (µm)	Take off Speed (m/min)			Die Gap (µm)		Roll (°C)		
	1600/ 800	0.4			2000		90/ / 70		

Table 2: Summary of Extruder parameters

The summary table above shows the temperature settings for optimizing the process, initially set higher due to the recycled content being used, but then returned to normal virgin PP extrusion conditions. The thickness of the sheet was reduced from 1600 to 800 microns. A melt filter was also introduced to try to filter out the black specs found in the sheet, later identified as nylon.

Indeed, it was later determined that the compounder had been running glass filled nylon material prior to this trial, and although the extruder was purged some residual PA contaminated the PCR-PP blend and this presented as brown gels during subsequent sheet extrusion.

This illustrates the importance, even during the recycling process to apply appropriate purging procedures.

Figure 6: Sheet made from 006-02 and 006-03

Thermoforming Trial

Using a single cavity tool with plug assist, two products, a deeper draw cup and a shallow draw bowl, were formed from the trial sheet at EVAL Europe's technical facility in Antwerp with the attendance of Nextek. Products were formed using "typical" conditions for each sheet thickness as indicated in the table below.

Thickness (µm)	Heating T (°C)	Heating T1 (s)	Heating P (bar)	Forming T1 (s)
1600	155	25	4	6
800	140	5	3	6

Table 3: Thermoforming conditions

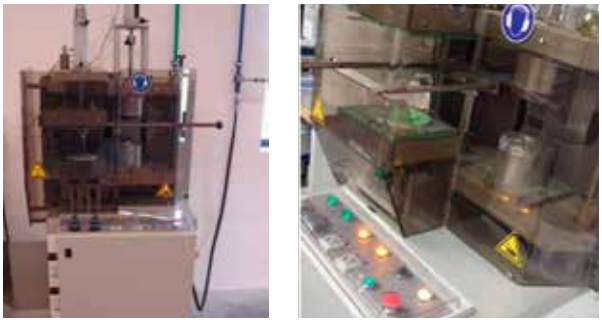


Figure 7: Single cavity thermoforming machine for sample cups and bowls

Products were well formed with good definition and no uneven thinning in the wall or corners, no other defects of any type were visible. Ten bowls or trays were made from each sheet variable to be used for migration testing. Cups from the 800?µm sheet had very thin walls as expected and bowls with the reduced draw depth were made with 800um sheet.

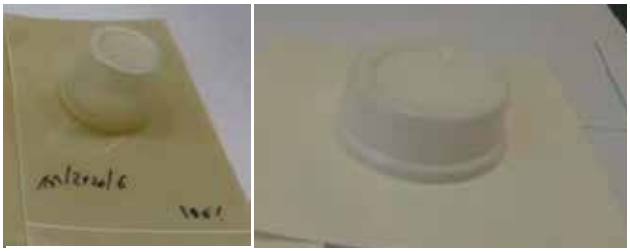


Figure 8: Cup using 006-01 and Bowl using 006-07

In trial #6 and #7, a white masterbatch was added. The added pigments were able to mask the grey/green coloration of the rPP material that was used.

Subsequent to this extrusion and thermoforming trial, EVAL Europe later also produced multilayer sheet structures using the PCR-PP,EVOH Blend 2 (25% PCR-PP/EVOH + 75% Moplen RP220M) compound and formed cups.

Trial #1: Blend 2 monolayer sheet, 825µm

Trial #2: Blend 2/Tie/VirginPP, 479/86/222µm

Trial #3: Blend 2/Tie/EVOH/Tie/Virgin PP,
490/29/30/37/208 µm

DRIVEN BY **INNOVATION**

There is no substitute for the experience we've gained by rolling up our sleeves and working through improvements at every stage of thermoforming technology for over six decades. From process design through putting high-output machinery on the floor, innovation is in our DNA.

BROWN MACHINE GROUP

Creators of world-class machinery, tooling and automation systems

*RUN WITH **CONFIDENCE***

BROWN LYLE Freeman NAS EPCO

For color control and quality purposes, the recycled material was also used in trial #3, a multilayer structure that is also commonly used when incorporating in-house regrind and potentially uses the EVOH as a functional barrier.

Migration Testing

Sample cups from 100% regrind (sheet sample 006-01) were sent to SMITHERS PIRA to conduct overall migrations studies. The institute recommended using iso-octane simulant at 40°C for 24 hours, accordance with EU regulation No 10/2011 and tested in accordance with EN 1186-15 rapid extraction test.

The test was carried out by filling the cups with the simulant and the average migration level of three samples tested was 41.8mg/dm3, which although at the highest allowable level does meet criteria for food applications after applying the reduction factor of 4 in accordance with the regulation.

Additional samples of multilayer bowls were then supplied for additional testing to determine the influence of a having a virgin PP inner layer and also of having an EVOH barrier layer present.

Results from this second round of testing under the same test conditions and using the filling method show the impact of the virgin PP layer and also of the barrier effect of the EVOH layer. Migration levels were reduced to a mean result of 9.9mg/dm3 for the bowl with a virgin PP inner layer and a mean result of 5.0mg/dm3 for the bowl that had the EVOH middle layer.

	EN 1186-15 Migration into Iso-octane (rapid extraction)		
	PCR-PP, EVOH (100%) monolayer	**PCR-PP, EVOH (25%) /PP**	**PCR-PP, EVOH (25%) / EVOH / PP**
Replicates	mg/dm²	mg/dm²	mg/dm²
1	42.4	8.8	4.8
2	40.1	10.9	4.9
3	42.9	9.9	6.5
4		10.1	3.9
Mean Result	**41.8**	**9.9**	**5**
Limit	40 (Corrective factor)	10	10

Table 4: Overall migration testing results, specified limit is 10.0mg/dm3

Physical Testing

The PCR-PP,EVOH compound physical properties were tested with PCR-PP and virgin PP to confirm no significant deterioration of properties from the PCR or the PCR-PP. MFR and Tensile testing was conducted by EVAL Europe, Impact testing and Density measurements were conducted by Nextek. Some impact was found on Strain at Break.

The resins used for the multilayer coextruded structures production being intended to be used in extrusion process with the possibility of the combination of materials next to the PCR-PP layer would allow adjustments to be made to take into account the physical properties requirements of the final articles.

Conclusions

Using 10% addition levels of post-industrial PP/EVOH regrind into post-consumer recycled PCR-PP, which represents a level of 5 times greater than that found in the PP fraction of the recycling stream and a upper range realistic figure of what could potentially be found in the recycling streams, it has been found that the presence of the EVOH at these levels has no significant impact on the food grade decontamination, and subsequent processing and physical properties compared to PCR-PP alone.

In addition, migration testing has shown that when PCR-PP is used as an external layer in EVOH multilayer structures, the EVOH is an effective functional barrier and it significantly reduces the overall level of migration from the PCR-PP to well below accepted limits even if the decontamination process actually super clean the rPP. This result provides a wide range of structure options to utilize PCR-PP in multilayer EVOH barrier packaging materials using EVOH as a functional barrier.

During the blending of food grade PCR-PP and post-industrial PP/EVOH granulate, a Polyamide residue in the extruder contaminated in the compound. This was not identified until the sheet extrusion stage, after decontamination. To a large extent the polyamide was able to be removed on the melt filter of the sheet extruder, however it illustrates the importance of a clean process with a good purging procedure.

Testing has shown that rigid PP/EVOH multilayer packaging will be detected as a PP article and sorted to the PP fraction by automated sorting units and that these multilayer packaging articles processed and utilized with monolayer PP packaging without any impact on the overall material properties of the PCR-PP. At some future time when food grade PCR-PP is commercialized, the presence of the multilayer EVOH packaging will not affect the performance of the decontamination process or the subsequent use of the food grade PCR- PP material back into food grade packaging applications.

These results indicate that there are no reasons that multilayer PP/EVOH structures could not be included in the recycling of PP packaging and that levels as high as 10% will have no significant impact on properties or performance of the recycled PP resins.

References

1. John Dixon, PACKAGING MATERIALS: 9. MULTILAYER PACKAGING FOR FOOD AND BEVERAGES, ILSI Europe Report Series, July 2011.
2. Rigid Food Packaging, BCC research Food and Beverage Report, FOD039C, July 2014.
3. Food and Drug Administration (FDA) 'Guidance for Industry: Use of Recycled Plastics in Food Packaging: Chemistry Considerations,' Division of Food Contact Notifications in the Center for Food Safety and Applied Nutrition (CFSAN) at the U.S. Food and Drug Administration, 2006, Viewed December 2016.
4. Food Packaging, EVALTM, Kuraray, viewed August 2019 www.evalevoh.com
5. Publication from Plarebel list on August 2019: https://www.werecycleplastics.be/
6. RECOUP Plastics Packaging, Recyclability by Design, 2016, Pages 11-12. Version visited on August 2019 at http://www.recoup.org/p/321/recyclability-by-design-versions
7. Cotrep Guidance, Follow the steps to find out our recommendations for your packaging! Viewed August 2019; https://www.cotrep.fr/en/steps/pots-and-trays/
8. Cyclos Verification and examination of recyclability ; http://cyclos-htp.de/fileadmin/user_upload/2019_Katalog/Verification_and_examination_of_recyclability_-_Revision_3.7.pdf ; viewed on August 2019.
9. Cotrep website: https://www.cotrep.fr/en/steps/pots-and-trays/ Viewed on August 2019
10. WRAP; Plastics Packaging, 'Plastic Packaging Composition 2011,' January 2013. I

Have an idea for an article?

Article length: 1,000 - 2,000 words.

Look to past articles for guidance

Format: .doc or .docx

Artwork: hi-res images are encouraged (300 dpi) with appropriate credits.

Send all submissions to:
Conor Carlin, Editor cpcarlin@gmail.com

ALL FINAL COPY FOR EDITORIAL APPROVAL

FEB 15 Spring

MAY 15 Summer

AUGUST 01 Fall

NOVEMBER 15 Winter

All artwork to be sent in .eps or .jpg format with minimum 300dpi resolution.

Pioneering Recycling Project in the Chilean Yogurt Market

A yogurt container made by Coexpan Chile has a removable label manufactured by Emsur Argentina which can be removed from the cotainer without leaving any residue, making it easier for consumers to recycle.

This new recyclability initiative is another step forward for the two plastic divisions of Grupo Lantero in their goal to foster circular economy principles.

Emsur Argentina has partnered up with Coexpan Chile to develop a specific removable banderole for dairy products for one of its key customers, Nestlé Chile. This innovation is distinctive for its easy peelability, making sorting for recycling a much simpler task for consumers.

The unique feature of this banderole is its releasing layer that enables users to remove the label without tearing the paper so it is easier to separate it from the container, thus contributing to the recyclability of plastics. This is another breakthrough for Nestlé that last year announced its commitment to make 100% of its packaging recyclable or reusable by 2025.

There are two structures available for this banderole, monolayer or duplex, to meet the needs of different market segments such as yogurts, desserts, and beverages. This solution is commercially available in Chile for the Nestlé Batido Brand. The multinational company has also launched an extensive communications campaign to mentor people in how to recycle properly with this packaging solution. More information is available on the Nestlé website where they have released a special landing page to inform yogurt consumers about how to recycle and where the waste recycling sites are.

Approximately 1,200 tons of plastic can potentially be recycled thanks to this initiative. This is an ambitious figure that can only be achieved if everyone disposes of their pots responsibly at the recycling sites set up by TriCiclos, an engineering and consulting company that has provided the 39 sites throughout Chile with new special waste disposal containers for Nestlé Batido pots.

Through this project, Emsur, the flexible plastic packaging division of Grupo Lantero, together with Coexpan, the rigid packaging division that makes the PS container, maintain their sustainability commitment in accordance with circular economy and recyclability milestones. Coexpan and Emsur teams envision a better future for plastics with their ecodesign. This recycling initiative makes it much easier to sort and separate rigid and flexible packaging from the same product, and draws attention to the increasing concern of leading FMCG (fast moving consumer goods) companies with regard to this issue.

EMSUR, with nine plants around the globe, showcased this innovation at Latinpack 2018. Its facility in Argentina is the country's leading manufacturer of flexible packaging for the dairy industry and it also produces packaging for other markets such as snacks, bakery, confectionery, as well as home and personal care. The company's specific expertise lies in sleeves, multi-layer sheets with médium-to-high barrier protection, as well as a wide variety of printing effects and finishes.

COEXPAN, a specialist in rigid plastic sheet and thermoformed products, contributes to this Nestlé project to allow the recyclability of its PS pot. The company is highly focused on the recyclability of plastics, and also participates as strategic partner in the LIFE EPS-SURE Project, an initiative backed by the European Commission through the LIFE+ Programme. It seeks to produce new, high value-added polystyrene (PS) products suitable for food contact after collecting, pre-treating and recycling expanded polystyrene (EPS) waste. Cicloplast, an association that integrates all the plastic sector companies in Spain is in charge of coordinating the EPS-SURE Project in which ANAPE, COEXPAN, El Corte Inglés and Total Petrochemicals Iberica all take part.

About EMSUR

Emsur is a division of the Grupo Lantero dedicated to the manufacture of flexible containers for packaging solutions primarily designed for the food sector and beverages, with both rotogravure and flexographic printing.

The company currently has 9 production plants (Spain, France, Poland, Russia, USA, Mexico, Argentina & Brazil) that allow them to conduct business in over 60 countries spanning the Americas, Europe, Africa, the Middle East and Asia. Mainly specialised in dairy, snacks and fresh food, Emsur produces up to 900 million square meters of sleeves, lids, labels, die cuts, pouches and other flexibles. http://www.emsur.com/

About COEXPAN

COEXPAN, a pioneer in extrusion with more than 45 years of experience in the industry, is the Group Lantero division specialised in the manufacture of rigid plastic sheet and thermoformed products, offering global solutions for the packaging industry.

COEXPAN has 13 production plants in 8 countries in Europe and America (Spain, France, Germany, Italy, Russia, Chile, Brazil and Mexico), specialised in rigid sheet solutions and thermoformed packaging in the main polymers (PS, PP, PET, PLA). COEXPAN boasts a production capacity of more than 200,000 tonnes per year. www.coexpan.com

For further information:

Customers Marketing Coexpan-Emsur, Amparo Cervera: amparo.cervera@coexpan-emsur.com

Brand & Communications Coexpan-Emsur : Blanca. dealfaro@coexpan-emsur.com I

Thermoforming Meets Thermoset Adhesive

An Intriguing Potential Solution for Semi-Structural Adhesives in Heavy Gauge Thermoforming

By Sally Austin, FLEXcon Industrial, San Antonio, TX

INTRODUCTION

For over 40 years, FLEXcon Industrial has pioneered high-performing adhesive tapes and laminates for use in durable goods applications. Now they have developed a new cutting-edge adhesive technology, which is a breakthrough for use with heavy gauge thermoforming plastics. This development addresses many common challenges in thermoforming by adhering similar and dissimilar substrates in-house. The new adhesive technology is an economical alternative to prototype capped parts and costly custom set-up costs.

PRESSURE SENSITIVE ADHESIVE VS. THERMOSET ADHESIVE

Pressure Sensitive Adhesives (PSA) are self-stick and form a bond when light pressure is applied to attach the adhesive with the adherend. No solvent, water or heat is needed to activate the adhesive. As the name "pressure sensitive" indicates, the degree of bond is influenced by the amount of pressure used. While PSAs are designed to form a bond and hold properly at room temperature, they typically reduce or lose their tack at low temperatures, and reduce their shear holding ability at high temperatures.

Thermoset adhesives are cured with a combination of heat, pressure, and time, resulting in crosslinking between polymer chains to produce a polymer network. The curing process creates an irreversible chemical bond that, unlike PSAs, prevents the material from being removed or repositioned. The bonded structure has superior strength and environmental resistance, which makes the use of thermosets optimal for structural and/or load-bearing applications.

LIQUID vs. TAPE

Liquid adhesive differs from adhesive tape and the name speaks for itself—liquid. The actual strength of liquid adhesives is only achieved when they have become hard because the actual adhesive is mixed with a solvent (curative) so as not to bond immediately. Liquid adhesives come in a tube or similar container that prevents the solvent from evaporating while allowing the adhesive to remain liquid. Only when the liquid is applied to the surface and exposed to the air does the solvent evaporate. The adhesive becomes hard and a solid bond is achieved. This process can take two seconds or several hours, depending on the chemistry of the adhesive, the nature of the bonding surfaces, and the evaporation rate of the solvents.

PSA tapes, on the other hand, are coated from a liquid base onto a substrate and dried during the coating process. Solvents are already evaporated, and the adhesive is ready for use, which brings new meaning to the concept of "holding fast." The protective and separating layer, or release liner, is removed and the adhesive tape is pressed to the surface and bonding occurs. No chemical reaction or drying time is needed.

Compared to liquid adhesives, thermoset adhesive tapes are far cleaner and simpler to use. The tape is simply cut to shape and placed between the materials to be bonded. The adhesive does not fully cure with chemical crosslinking until heat and pressure are applied. Therefore, the adhesive can be pre-applied to one substrate and then stored or even shipped, thus greatly reducing processing time when bonding materials together. No messy clean-up is required, and components can be handled immediately upon cooling. The thermoset adhesive tape cures during the heat and pressure process and develops full strength quickly as it cools. These tapes are ideally suited for bonding dissimilar sheets during the thermoforming process.

Using adhesive tapes in place of liquid adhesives has distinct advantages in industry. Simple, flexible handling, and quick adhesion accelerate the processes and even optimize the end-use products. Uneven surfaces may be evened out with adhesive tape. The entire process goes

very quickly, since drying time is irrelevant as opposed to liquid adhesives. In addition, adhesive tape is clean. Follow-up work in order to remove the remains of the adhesive is not necessary.

TACKY THERMOSET

A thermosetting, or B-stage, adhesive tape fully cures (chemically crosslinks) under heat and pressure. When the tape is delivered to the end user, the reaction between resin and crosslinker is not complete. In a liquid adhesive, that usually indicates that the resin and crosslinker have not been physically mixed. In an adhesive tape, that usually means the resin and crosslinker have been mixed, but something is blocking the chemical reaction from taking place. When this system is heated above an activation temperature, the crosslinking is complete, and the system fully cures.

Most thermosetting adhesive tapes are tack free at room temperature, meaning they have no bonding ability until they are heated, and crosslinking occurs. Tacky thermosetting adhesive tapes provide an initial bond like a PSA tape. They bond to much higher strength, however, once crosslinking occurs from heat activation. This novel semi-structural tape might be useful for various projects and applications.

FLEXcon Industrial currently provides two distinct types of thermosetting adhesive tapes:

- Non-Tacky Thermosetting Adhesive Tapes
  - Completely non-sticky at room temperature
  - Requires heat and pressure to achieve full cure
- Tacky Thermosetting Adhesive Tapes
  - Tacky at room temperature, providing initial bond without heat or pressure
  - Requires heat and pressure to achieve full cure and high bond strength

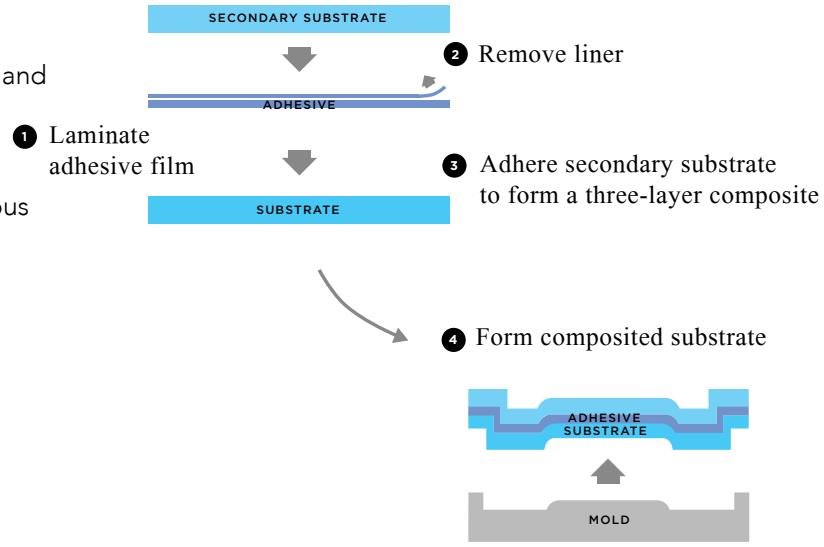
The tacky thermosetting tapes can be divided into different versions of adhesive chemistry exhibiting various properties, including:

- Medium and high surface energy substrates (e.g. Kydex, PET, Metal, ABS, Acrylic, HIPS)
  - Lowest tack adhesive for bonding dissimilar surfaces
  - Higher tack for improved quick stick
  - Paste-like adhesive film designed for flow/ saturation during curing
  - High tack adhesive for bonding high-energy substrates, such as metals
  - Lower temperature curable
- Low to medium surface energy substrates (e.g. TPO, BOPP, PE)
  - Adhesive for bonding dissimilar surfaces (High/low energy surfaces)
  - Adhesive for bonding dissimilar surfaces-lower temperature activation

Thermosetting tape is designed to cure or bond under high heat and pressure. This tape can be used to bond similar and dissimilar heavy gauge plastic sheets with vacuum and/or compression form processes. Prior to forming, the materials are coated with the adhesive at full web (up to 60 inches wide) by laminating the tape onto one plastic sheet and then sandwich between the second sheet layer. While machine lamination is preferred over manual methods to marry the adhesive to a specific substrate, hand lamination is relatively straightforward and can be rolled, squeegeed and then trimmed by scissors or knife, if needed.

TACKY THERMOSET IN THERMOFORMING

The tacky thermoset adhesive film is supplied in roll form with a release liner. Pre-attaching is done at room temperature. The protective release liner is removed immediately prior to adding a secondary substrate to ensure a clean defect-free part. The process flow for adhering two substrates is illustrated below:



WELDED PLASTICS

FLEXcon Industrial's thermoset adhesive tapes cure with heat and pressure under the same conditions typically used during the thermoforming process. The adhesive stretches with great elasticity and welds layers of plastic film together when the activation temperature is reached. Full strength typically develops after the piece has been allowed to cool. Testing has shown that maximum strength develops approximately 60 minutes after forming and is not affected by ambient conditions.

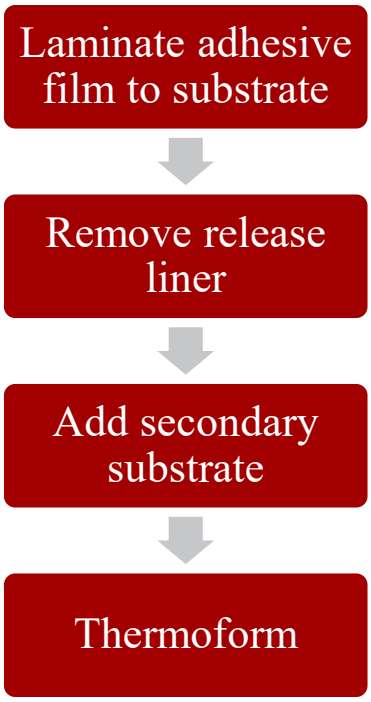
Sheets of varying thickness can be bonded. During testing, a tacky thermoset tape with .002-inch adhesive coating thickness was applied between .080-inch and .125-inch plastic sheets with the intention of draping or "capping" a few .050-inch materials on a core product. Some applications require increasing the adhesive thickness, for example when using sheets with thickness of .125-inch or higher. Up to .004-inch of adhesive can be coated in one pass. However, because these thermosetting adhesive tapes have initial tack, they can be layered together to increase coating thickness to .004, .008 or .012 inches prior to forming.

Plastics successfully welded to date:

- ABS and ABS
- Kydex and Kydex
- Kydex and ABS
- Kydex and HIPS
- HIPS and ABS
- TPO and ABS
- Kydex and Naugahyde (Synthetic Leather)
- Acrylic and ABS

SOLUTION TO COMMON PROBLEMS

The process of welding two plastics together is similar to twin-sheet thermoforming in that both processes heat adjacent plastic sheets simultaneously, then form and fuse the two sheets together in order to create the finished product. However, twin-sheeting only fuses at specific pressed points to make hollow or double-walled three-dimensional parts. The adhesive film used in thermoforming welds the two plastics together on the same mold into one solid piece. Twin sheeting is optimal when merging two sheets of the same substrate. While marrying two differential substrates together through twin sheeting might be possible, the equipment itself is quite expensive.



Plastic sheet extruders offer a 'cap' layer laminated to a sheet with a 'tie' layer, which bonds the cap to the base sheet. Since those custom runs require a special set up, the sheet extruders require a minimum run to cover their fixed costs. Typically, these custom sheets are only available in Minimum Order Quantities (MOQ), which are typically larger than the average job shop run, resulting in excess inventory of remaining materials. To solve the problem of high MOQ, thermoformers can essentially supplant the function of a tie-layer in-house with the use of the tacky thermoset. With tacky thermosetting tapes, thermoformers' customers could buy the separate components in smaller quantities and use the tacky thermoset adhesive as a tie layer rather than pay the extruder to do so as a custom service.

Being able to bond two substrates during the thermforming process has huge advantages as bonding post process is time-consuming. Currently, a thermoformer must form each piece, cool them, and then apply the adhesive to marry the parts. Gaps can be an issue since the parts were not initially formed together as one solid piece.

Fusing sheets in-process forms bonds rapidly, resulting in higher assembly speeds and short fixturing time. Benefits include speed, low cost, and clean, easy handling of material. Superior strength and integrity of the product is achieved by welding two substrates together into one fused piece. Thermoformers will have more design freedom and shorter time to market, in addition to the absence of capital investment of new machinery. Minimum Order Quantities are low, enabling the ability to prototype, and to promote innovation at relatively low cost.

CONCLUSION

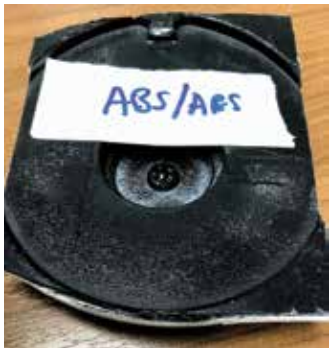
On a cost-per-square-meter basis, prices will start at US $4 with higher prices for thicker adhesive and liner systems. In considering total cost, a thermoset film adhesive has several advantages:

Key Benefits

- Excellent bond strength
- Resistant to moisture and chemicals
- Cleaner and simpler to use than liquid
- No high cost of twin sheet machine
- Two-color option; custom color layering
- Increased structural stability when cured
- Low MOQ reduces development costs
- Time saving to adhere during process

All these advantages make FLEXcon Industrial's adhesive technology an intriguing potential solution for common thermoforming challenges.

For more information, visit our website: www.flexconindustrial.com.



A Review of Thin-Gauge Thermoforming Technology from the 2019 K-Show: Part 1

By Mark Strachan, Principal, Global Thermoforming Training International LLC, Jupiter, West Palm Beach, FL

This was now my 7th consecutive K-Show experience and I must say that it proved to be one of the most exciting 7 days of my thermoforming career. Although I walked over 10,000 steps a day, I did not get to visit all 17 halls. Fortunately, most thermoforming machine OEMs were situated in Hall #3 on the sprawling complex of Europe's largest industrial fairground.

photo: Messe Düsseldorf/ctillmann

I believe that we are living in exciting times as the technology now available to the plastics manufacturing industry is allowing for the much-needed ability to vastly increase production efficiencies, reduce labor costs and minimize downtimes. I am convinced that if you do not allocate the time and resources to these incredible tools and resources now at our fingertips, you will be left behind to eat the dust created by those who do embrace it

In this report, I present an overview of the various machinery platforms showcased at K this year along with the benefits of each. I also draw attention to special features that promote the ever-growing demands on the packaging industry for resource reduction (reduce, reuse and recycle), sustainability, and circular economy. I present what I deem to be essential tools and emerging technologies that need to be considered by all engaged in today's thin-walled thermoforming packaging manufacturing environment. Also, please note that I am not suggesting that any of the companies discussed below are the first or the only ones to utilize the systems or technologies mentioned. I am merely pointing out what was showcased at the K-Show.

Thin Gage Thermoforming Configuration # 1

Three Station: Form / Trim / Stack – all operations are performed in separate stations while material is still captive in the chain rails. The form/cut/stack thermoformer configuration is suited for the food, medical, and industrial packaging markets.

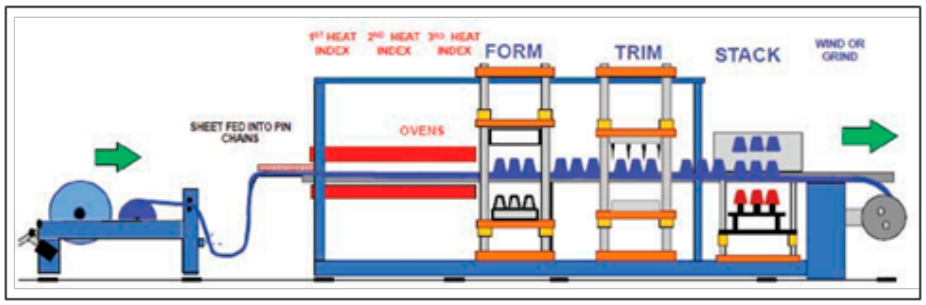


Figure 1: three station form/trim/stack, flat-bed configuration

Although this has been one of the most widely utilized platforms and is now available from many OEMs, this year it was showcased by, among others, Kiefel Technologies GmbH (Freilassing, Germany) with their completely revamped KMD78.2 steel-rule machine, with separate forming and trimming stations and an up-stacker system which produced rPET Trays using a 18-cavity tool at a remarkable rate of 48 cycles per minute.

The form/trim/stack configuration was also showcased by GN Thermoforming Equipment (Chester, NS, Canada) on their new GN580 thermoformer. The GN580 ran a 100% post-consumer recycled PET meat tray tray using a common-edge tool, producing with minimal scrap. Over the years, GN has perfected common-edge-cut tooling technology for its line of thermoformers. The tooling offers the ability to form a series of square or rectangular trays in a row or multiple rows while eliminating the web between the products. As an example, In the illustration, I show a 9-cavity tool trim layout for what I call a generic *config = B and a common trim config = A.*

photo: Messe Düsseldorf/ctillman

Config. A has the advantage of a linear length of trim of 24" less and a sheet index of 1" less than Config B. This translates to less cut pressure, less trim hardware, and a vast material savings due to the reduced index length.

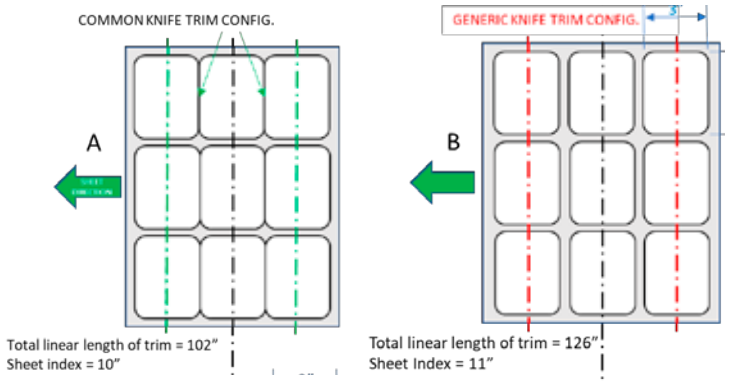


Figure 2: common knife vs.generic knife configurations

Another example of the form/trim/stack forming configuration was showcased by AMUT-COMI Thermoformers (Vigevano, Italy) who were running a 4-cavity soup plate mold using a metallized 100% rPET sheet manufactured with glueless technology. The ACF820 thermoformer machine demonstrated the use of a vision system installed between the form and trim press

The vision system detects the quality of the formed parts still positioned in the web as they are moved out of the forming station. If any parts are found to be defective, the trim press will receive a signal to not trim that entire index, which will then bypass the robotic stacker and be taken directly to the granulator or web winder. Another option is to trim the parts but not stack them.

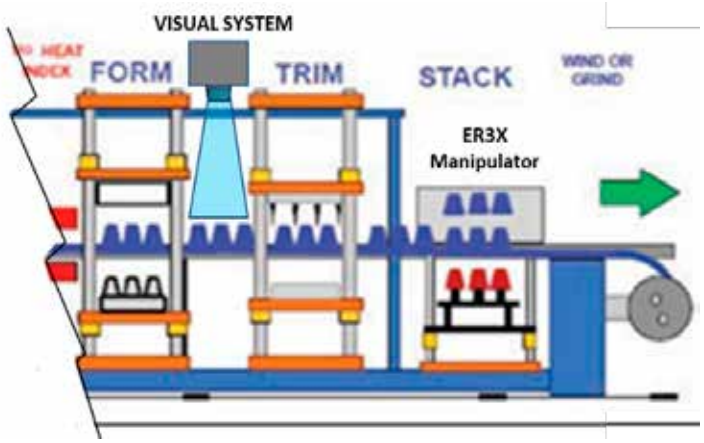


Figure 3: form/trim/stack configuration with added vision system

This option could, of course, include an infrared camera at the same position (Fig. 3) to ensure all parts are cooled evenly as they lave the form station. This would be an important feature for semi-crystalline materials that have a higher rate of shrinkage and thus are affected by the cooling duration.

Thin Gage Thermoforming Configuration # 2

Four Station: Form / Punch / Trim / Stack – all operations are performed in separate stations while material is still captive in the chain rails. The form/punch/stack thermoformer configuration is also suited for the food, medical and industrial packaging markets.

The option to include an additional press in this flatbed configuration is available from many thermoforming Machinery OEM's as it is a very efficient way of punching holes in parts before the part is trimmed out of the web. This year the four-press configuration was showcased by OMG (Torino, Italy) but with the 2nd punch press station inactive. OMG ran a clarified PP fruit tray with Milliken clarifier.

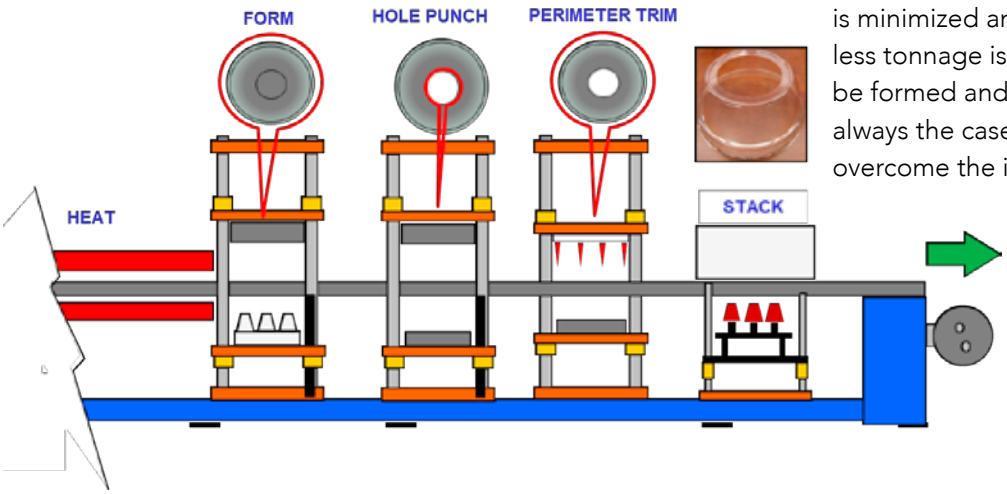


Figure 4: four station form/trim/stack configuration

WM Thermoforming Machines (Stabio, Switzerland) presented a four-station system with a difference:

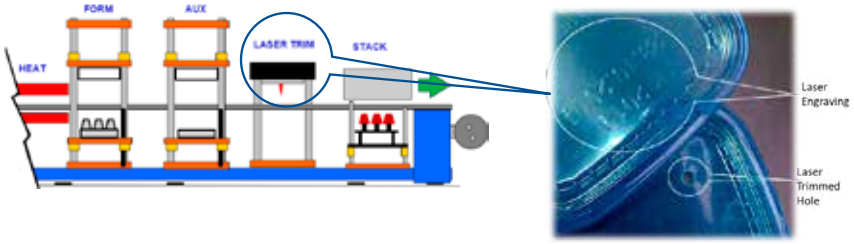


Figure 5: four station form/aux/laser trim/stack, inline configuration

The Flex 92 Thermoformer Model with TLA (Thermoforming Laser Application) proved to be a huge draw for WM as they showcased a 24-cavity, square deli lid being cut-in-place in the form press, then trimming a hole on one lid, and engraving on another at the cycle rate of 30 cpm. I was informed that only one laser head was in use and that multiple heads could be added to engrave and or punch out holes in all 24 lids.

Although laser trimming of plastics is fast gaining ground, it has not yet become commerciality viable for high speed, high volume in-line thermoforming, or has it?

Thin Gage Thermoforming Configuration # 3

Two Station: Form/Trim-in-Place / Stack – the form and trim operations are performed in one station and then the parts are moved to the next station downstream for the stacking operation

The trim in place forming configurations allows for accurate formed part-to-trim registration. Because the sheet is trimmed while it is still warm, the likelihood of angel hairs is minimized and in some machinery cases, because less tonnage is required for trimming, more parts can be formed and trimmed per cycle. This is however not always the case as it is machinery dependent (force to overcome the inertia for 2nd trim action).

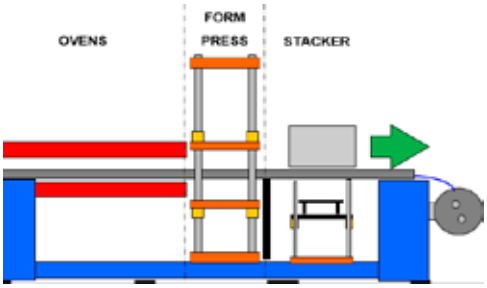


Figure 6: 2-station trim-in-place / stacker

This steel rule, trim-in-place forming configuration was showcased by WM Thermoforming Machinery with their Flex 92 thermoformer. The steel rule trim-in-place tooling offers reduced tooling costs while still being capable of accommodating the required 50+ psi of form air pressure. The trick is in the mounting of the steel rule knives and the precision welding of the join. This is now made much easier by new, extremely high-precision CNC benders and seam welders available in the market today. The high precision lid tool showcased by WM on their Flex 92 was manufactured by Marbach Tooling (Heilbronn, Germany).

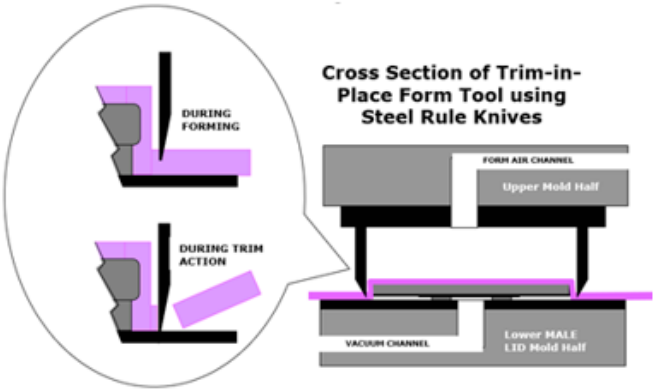


Figure 7: example of form / trim-in-place tooling configuration (male lid tool)

ILLIG Maschinenbau GmbH (Heilbronn, Germany) also showcased the form and trim-in-place forming configuration with their new IC-RDK 80 trim-in-place thermoformer with a very unique and impressive

thermoforming in-mold labeling system (IML-T®). In this production line, 92mm diameter round labels are manufactured on a 30-up tool. The lids are brilliantly decorated with paper labels. The lids are made out of 0.35 mm rPET. Manufacturing costs of decorated thermoformed lids are 20 percent lower than costs for injection-molded lids since the weight is substantially lower, the output is higher, and machine investment is lower.

photo: Messe Düsseldorf/ctillmann

The labels are moved from a magazine to the upper form tool half using a shuttle-style table. The adhesive on the label is activated by the latent heat of the sheet while the form air pressure pushes the label firmly against the formed plastic sheet. The labeled and trimmed parts are then moved with the web to the downstream stacking station, where they are conveyed to a Kilde (Skive, Denmark) Flexpacker automation system and packed into pre-erected cartons.

Figure 8: IML-T lids and labels from ILLIG

Thin Gage Thermoforming Configuration # 4

Match Metal Form & Trim in Place – the difference between the match metal and the steel-rule knife trim configuration shown above is that a matching punch and die is used within the form tooling to trim the parts. An integral coining feature is usually included in this configuration as the coiner device helps to flatten out the flange of the parts while acting like a sheet clamp. The coiner can be temperature controlled and the coining pressure can be adjusted to allow for thicker or thinner flanges.

There are many ways in which the formed and trimmed parts can be ejected from the mold cavities, but the most popular is to move the lower tooling half down and away from sheet line with parts still in the mold cavities) and then tilt the entire lower tooling to a part retrieval and stacking device. It is the chosen method to manufacture cups and tubs and other similar part geometries, but not suited for large trays such as salad bowls.

This technology was showcased by many OEMs at this year's K-Show and I must say that most were very impressive. ILLIG Maschinenbau GmbH presented their 4th Generation RDM 76K automatic roll-fed machine with a newly designed PH 76 part handling and end packaging

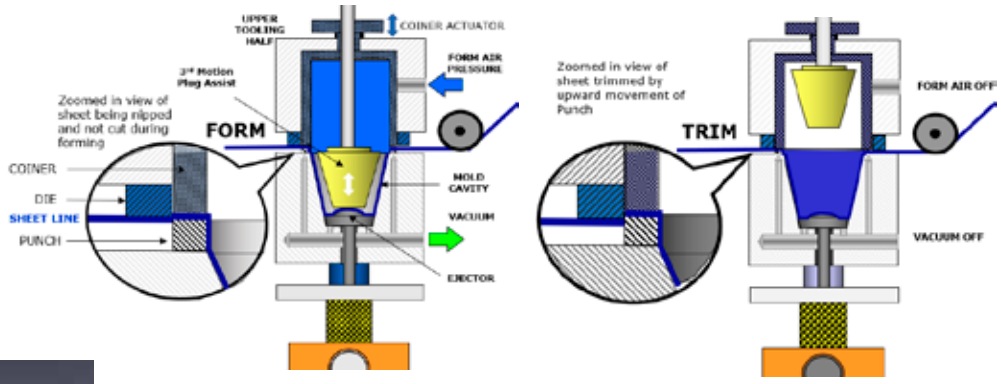


Figure 9: Shows the components of a typical match metal trim-in-place tool with integral coining device. The call out bubbles show the position of the punch and die during the forming of the part and then the trim action soon after.

solution. The completely re-designed double servo drive of the production system ensures shorter movement times and thus faster cycle times. ILLIG increased the closing force by 50 percent to 900 kN resulting in 50% increase in the available cutting length. The electronic parallelism setting of upper and lower table and the integrated tool

block change system reduces tooling times to less than one hour. I observed the RDM 76K seamlessly running a 1.3 mm rPET to form 75 mm diameter x 100 mm high U-rim drinking cups on a 60-up (lightweight design) trim and tilt tool. I also stayed to watch the tool change demo and was pleasantly surprised by the ease of operation.

Kiefel Technologies revamped their KTR 5.2 SPEED thermoformer with a new heating concept and intelligent cooling system and optimized forming air flow (filling and venting) for consistent material distribution and increased product quality. The increased punching force of 400kN allows for more cavities. This all rolled into a very attractive enclosure and new user-friendly HMI operator interface.

photo: Messe Düsseldorf/ctillmann

Gabler Thermoform GmbH & Co. KG (Lubeck, Germany) did not disappoint by presenting their new "SWING 3" match metal trim-in-place and tilt thermoformer. This machine was designed to be flexible as it can forms cups, trays and lids equally well. The unique angle of the chain rails and top form platen allows for only minimal swing for the lower form platen to move the formed and trimmed parts into the stacker magazine. This angle also allows for easy nesting and control of shallow items such as lids.

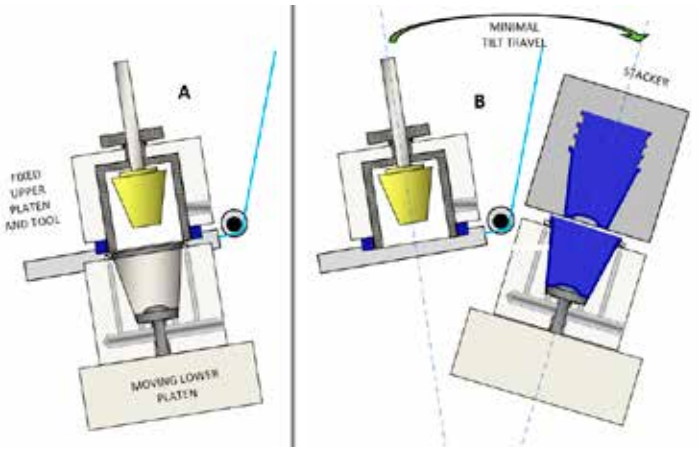


Figure 10: illustration of Gabler "Swing 3" concept

I observed the Swing 3 run double walled clear thermoformed cups, which was achieved by running a smaller inner cup alongside a larger diameter cup in the same tooling layout. This tool was also manufactured by Marbach.

MEAF Machines (Yerseke, Netherlands) exhibited its newly designed KMS600 thermoformer which combines tilting technology with a linear driven actuator. This makes the KMS600 a reliable, low-maintenance and durable asset. It is an ideal asset for medium- to larger-sized companies that require higher outputs (around 40.000 cups/hour) and process efficiency.

This forming configuration was originally designed for high volume output and is widely used in the USA with forming areas up to 65"x 67".

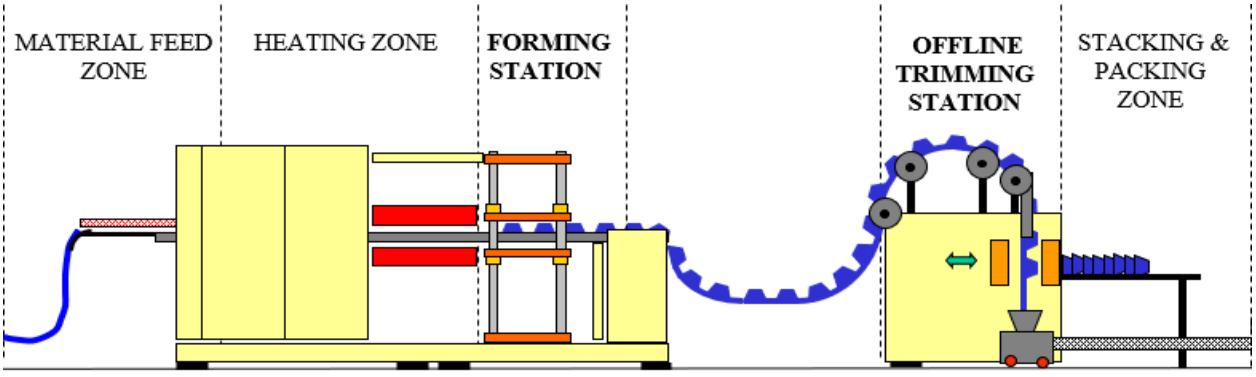


Figure 11: classic US-style form / post-trim configuration

Thin Gage Thermoforming Configuration # 5

Large Bed Continuous Thermoforming Line with Off-Line Trim and Stack

This forming configuration was originally designed for high volume output and is widely used in the USA with forming areas up to 65"x 67".

Because of the large forming area, it is possible to run molds with hundreds of cavities and because of this, it would be virtually impossible to trim the total linear length of the parts with a single trim action. A very large and powerful press would be required. For this reason, the formed parts are left in the sheet and fed into a stand-alone match metal trim press, which trims only one or sometimes as much as three rows of parts at a time. The diagram shows a form tool with 4 rows of parts and the trim tool with only one row of parts. The trim press would thus have to cycle 4 times faster than the form press to keep up.

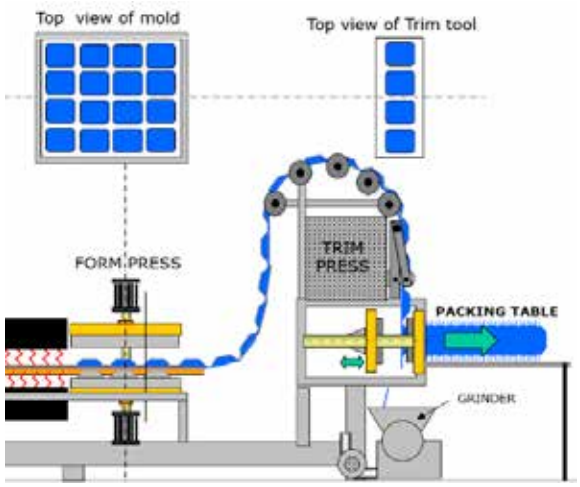


Figure 12:illustration of forming mold and trim tool for post-trim configuration

Figure 13: Example of package where part was trimmed off the horizontal plane

This configuration is also used for parts that require to be trimmed off the horizontal plane. In other words, you could cut a packaging blister in half to expose the handles of a pair of pliers. Match metal post trim allows for profile cuts that are not possible with knife-like trimming against a flat plate.

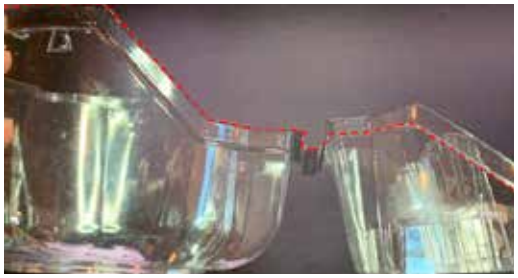


Figure 14: Clamshell design trimmed on horizontal punch press

Although this forming configuration is usually showcased by North American companies such as TSL Thermoforming Systems, Brown Machinery Group, Irwin Research and Development was the only company to exhibit their latest offerings at the K show this year. Irwin (Yakima, WA) showcased their new Model 45 thermoformer with "saddle style" platen system and 125 tons of forming tonnage. The newly-designed press closing features allow the presses to move to sheet line, straightening out the toggles before a secondary actuator moves the lower press platen up further to squeeze the platens together. This minimizes the load on the toggles during closing and opening and ensures longevity of the bushings and linkages. Irwin have now also included an intelligent 4-point platen loading monitoring system that ensures the shut height to a 0.001" tolerance from corner to corner.

Part 2 will focus on automation, controls, software developments, and more. I

SPE Thermoforming Division Parts Competition 2019 Award Winners

Photos: Dallager Photography

People's Choice Award Winner: Two-Sheet Glued Versatile Cab Roof from Plastics Unlimited

Cut-Sheet Heavy-Gauge Pressure Forming, Silver Winner: Motor Drive Cover, Profile Plastics

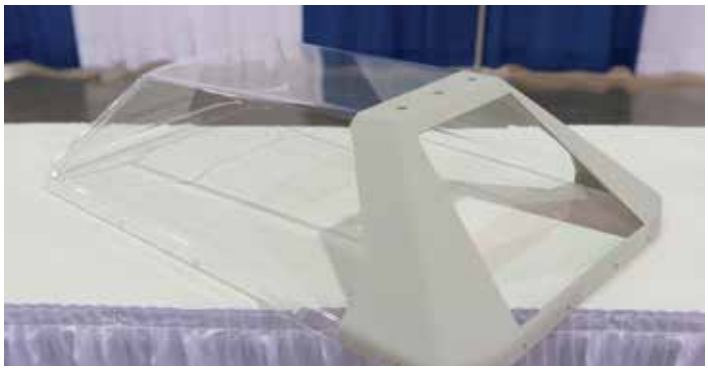
Roll-Fed, Thin-Gauge Gold Winner: Ortho-Fix Tray, Placon

Roll-Fed, Thin-Gauge Silver Winner: Ortho-Fix Tray, Placon

Roll-Fed, Thin Gauge (Food), Gold Winner: Simply Secure, Lindar

Roll-Fed, Thin Gauge (Food), Silver: HomeFresh Entrée, Placon

Roll-fed Thin Gauge (Sustainable): Gun Cleaning Kit, CMI Plastics

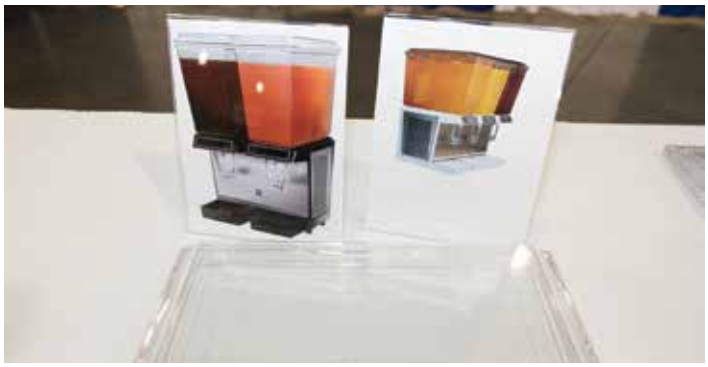


Cut-sheet, Heavy Gauge Vacuum Forming, Gold Winner: NeoNatal Care Unit, Profile Plastics

Cut-sheet, Heavy Gauge Vacuum Forming, Silver Winner: Door Assembly for Tankless Hot Water Heater, SAY Plastics

Cut-Sheet Heavy-Gauge Pressure Forming, Gold Winner: Stratasys F Series 3D Printer Enclosure, Ray Products

Cut-Sheet Heavy-Gauge TPO, Gold Winner: Camper Cover, Kal Plastics



Twin-Sheet Heavy-Gauge, Gold Winner: Beverage Dispenser Lid, Profile Plastics

Cut-Sheet Heavy-Gauge Parts Produced with Automation and New Technology, Gold Winner: Medical Equipment Enclosure, Wilbert Plastic Services

Thermoform Recycling Operation Coming to California

November 6, 2019 - Dan Leif, Resource Recycling

A Mexican company that developed a system to process post-consumer PET thermoforms will open a $7 million plant in the Los Angeles area. It's now on the hunt for thermoform bales.

Green Impact Plastics is currently handling recovered PET thermoforms at a site in Ciudad Juarez, Mexico, said company owner Octavio Victal. He noted that since March, the operation has been dialing in its processing system in a partnership with California reclaimer rPlanet Earth.

The two companies recently ran a trial in which 1 million pounds of thermoforms, purchased from California materials recovery facilities (MRFs), were transported to the Juarez facility. Green Impact processed the plastic and then shipped clean flake to rPlanet Earth's Vernon, Calif. site, where it was fed into rPlanet's thermoform sheet production line.

Representatives from both companies told Plastics Recycling Update they deemed the trial a success, and rPlanet Earth signed an offtake agreement with Green Impact. That has opened the door to higher output volumes in Juarez and a new facility in California, which is slated to open in the second quarter of 2020, according to Victal.

The $7 million California plant will be located in Vernon, approximately two miles from rPlanet's facility. The site's capacity will be 4 million pounds a month, and the existing Mexico plant is scaling up to a capacity of 2 million pounds a month.

"That will give us a nice 6 million pounds of capacity of thermoforms, which will all come back to rPlanet Earth to be turned into a food packaging product," Victal said. "We are definitely thinking thermoform recycling is going to be the next big thing."

Strategy for 'A Unique Resin'

Though PET recycling is well-developed in North America, the existing infrastructure is focused primarily on bottles. As PET thermoform packaging – often in a "clamshell" format – has grown in use in the U.S., recycling companies have found the material to sometimes be difficult to integrate into the system.

Labels on thermoform containers are often paper-based and affixed with adhesives that make them difficult to separate from the plastic. The characteristics of the PET in thermoforms also differ from that used in bottles. That can cause problems if thermoform resin is mixed with bottle resin at too high of a percentage.

"You've got to look at thermoforms almost as a unique resin," said Joe Ross, co-CEO of rPlanet Earth. "You can't just lump PET all into the same pot because the sheet to make thermoforms typically starts out with a much lower [intrinsic viscosity] compared with bottles. And because they're in almost two different stratospheres, to blend them together and homogenize the IVs is almost impossible."

Such recycling barriers have kept thermoform materials out of many local recycling collection programs. According to Bob Daviduk, rPlanet's other co-CEO, the state of California has estimated that around 250 million pounds of thermoforms are sent to disposal in the state annually.

Leaders from rPlanet Earth and Green Impact Plastics celebrate the opening of Green Impact's Juarez, Mexico facility this spring. From left: Bob Daviduk, Joe Ross, Octavio Victal and Juan Pablo Victal. | Courtesy of Green Impact Plastics

For stakeholders that make and use thermoform packaging, the lack of recycling has taken on added urgency, with lawmakers in California threatening to bring on policy that would outlaw packaging types that cannot reach certain materials recovery thresholds.

"In California in particular, the produce growers all have become very concerned," Daviduk said

Figuring out a Process

In Mexico, Victal and his brother, Juan Pablo Victal, have spent a number of years working through the intricacies of thermoform processing. (Octavio Victal was also co-founder of a bottle recycling operation called Tecnopenales that closed in 2014.)

According to rPlanet's Ross, Victal has developed a particular expertise on the thermoform front. It made more sense for rPlanet to partner with him than to try to figure out how to best handle the stream on its own.

"There's all these trade secrets that Octavio's learned with regard to the size of the flake, how to convey the flake, the wash line chemistry," Ross noted. "We would have been literally spending five years trying to crack the code on what he's already learned in his time doing it."

Victal said his plant in Juarez is 32,000 square feet and uses machinery from Chinese manufacturers. He describes the setup as "a modified bottle wash line." He noted it relies on an intensive filtration system to handle the pulp from labels and modified spin dryers to help reduce "fines," the smaller pieces of material that can be problematic in processing.

The facility in Vernon, an industrial-focused city just southeast of downtown Los Angeles, will be 54,000 square feet and will be housed in an existing building. Green Impact is currently finalizing permitting details with the city and is working with an engineering group to get the space ready for equipment installation.

Victal said the company is leasing the building with an option to buy. And he noted the $7 million that will be needed for equipment purchasing is being provided by private equity. He said he also has approached industry group Closed Loop Partners for financial support.

Victal said rPlanet Earth is involved only through the offtake agreement for material – it is not providing funding for the new facility.

"We are using the offtake agreement to leverage our investors," Victal said. "One-hundred percent of the material is already sold."

Looking for Thermoform Bales

Victal said that with rPlanet in place as a buyer and processing plans set, the key now is securing supplies of material from MRFs.

He said he has been working with Plastic Recycling Corporation of California (PRCC) to connect with MRFs and help them see the value of investing in equipment and taking other steps to make thermoform-only bales.

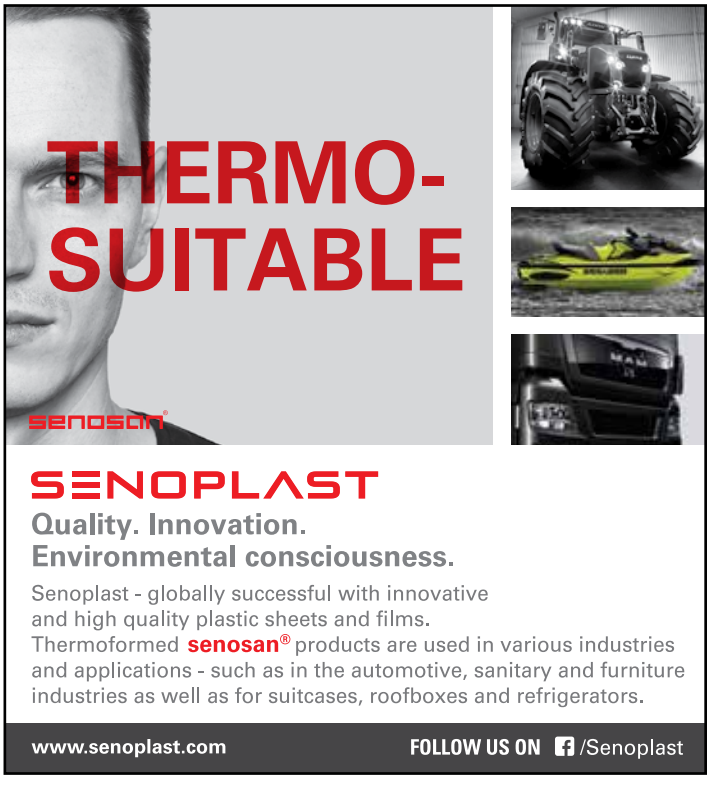
"We're making sure they understand there's a market for it," he said. "We want to flush out as much volume as possible."

He noted that when the California operation comes on-line, the Mexico site might be able to start accepting bales from other regions of the U.S.

Daviduk of rPlanet said the the partners expect economics to drive the thinking of MRFs. Currently, MRF operators are often paying to send thermoform material to disposal, or they are lowering the quality of PET bales when they mix thermoforms with bottles.

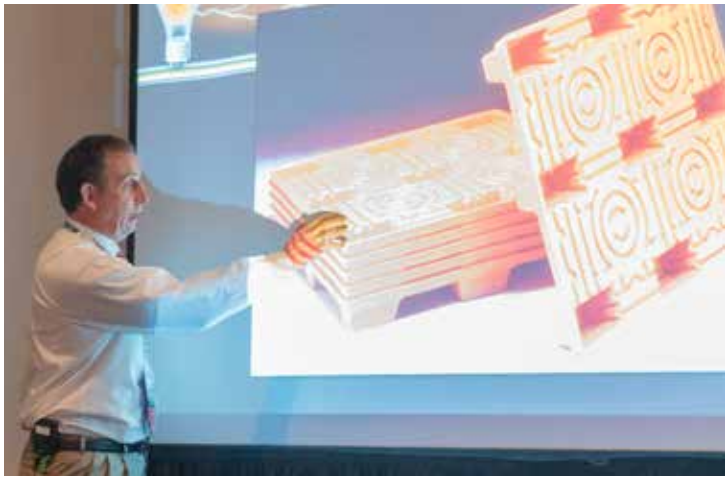
Having a clear market "for those bales creates not a large revenue stream but at least a revenue stream that presumably will entice them to invest in more automated sortation," Daviduk said. "It's a good story – the fact that MRFs can say, 'Instead of sending this material to landfill, it's now getting recycled.' That's good for everyone involved.'"

This article was re-published with permission from Resource Recycling Magazine. All rights reserved.



2019 Thermoforming Conference

Dr. Brian Landes, SPE President, delivers the annual keynote address with a focus on sustainability.



Robert Browning leads the heavy gauge technical seminars.

Vendors and visitors mingle on the exhibit floor.

Randy and Brad of TPS present their adjustable clamp frames to visitors.

Visitors inspect parts on display at the annual Parts Competition.

Tom Haglin (center) receives the Thermoformer of the Year award from Division Chair, Eric Short (left) and 2018 Thermoformer of the Year, Bob Porsche (right).

12th EUROPEAN THERMOFORMING CONFERENCE 2020

18–20 MARCH 2020 | GENEVA | Switzerland

MARK YOUR CALENDARS AND DO NOT MISS THE ONLY EVENT THAT IS DEDICATED TO EUROPE'S THERMOFORMING INDUSTRY.

The European Thermoforming Division invites you to the **12th European Thermoforming Conference** to be held in Geneva from 18th to 20th March 2020.

CONFERENCE HIGHLIGHTS

- Keynote Presentations
- Technical Sessions
  Thin & Heavy Gauge
- Workshops
- Exhibition
- Networking Events
- Parts Exhibition

Who should attend? Thermoformers, OEM's, Machinery & Tooling Producers, Film and Sheet Suppliers, Resin Producers, Recyclers … Venue: Starling Hotel in Geneva welcomes you.

Further information about this event may be obtained from Yetty Pauwels
at Society of Plastics Engineers, Thermoforming Europe Division
Tel. +32 3 541 77 55, spe.etd@skynet.be
www.e-t-d.org

european thermoforming division

spe

MACHINERY COMMITTEE

James Alongi
MAAC Machinery
590 Tower Blvd.
Carol Stream, IL 60188
T: 630.665.1700
jalongi@maacmachinery.com

Steven Clark (Chair)
Monark Equipment
PO Box 335
4533 S. Garfield Road
Auburn, MI 48611
T: 989.662.7250
sclark@monark-equip.com

Brian Golden
SencorpWhite
400 Kidd's Hill Road
Hyannis, MA 02601
T: 508.771.9400
bgolden@sencorpwhite.com

Travis Kieffer
Plastics Unlimited, Inc.
303 1st St. N.W.
Preston, IA 52069
T: 563.589.4752
TravisK@plasticsunlimited.com

Brian Winton
PTi
2655 White Oak Circle
Aurora, IL 60502
P: 630-585-5800
E: bwinton@ptiextruders com

MATERIALS COMMITTEE

Juliet Goff
Kal Plastics
2050 East 48th Street
Vernon, CA 90058-2022
T: 323.581.6194
juliet@kal-plastics.com

Roger P. Jean (Chair)
Simona PMC
PO Box 1605
2040 Industrial Drive
Findlay, OH 45840
T: 567.208.9758
Roger.Jean@simona-pmc.com

Phillip Karig
Mathelin Bay Associates LLC
11939 Manchester Road #148
Saint Louis, MO 63131
T: 314.630.8384
karig@mathelinbay.com

Ian Munnoch
MSA Components, Inc.
6556 County Road KP
Mazomanie, WI 53560
T: 812.322.5080
imunnoch@msacomponents.com

Matt O'Hagan
LyondellBasell
7674 Park Meadow Lane
West Bloomfield, MI 48324
T: 248.760.8590
matt.ohagan@lyondellbasell.com

Laura Pichon
Ex-Tech Plastics
PO Box 576
11413 Burlington Road
Richmond, IL 60071
T: 847.829.8124
lpichon@extechplastics.com

Ed Probst
Probst Plastics Consulting
P.O. Box 26365
Wauwatosa, WI 53226
T: 414.476.3096
ed.probst@probstplastics.com

Eric Short
SIMONA PMC
2040 Industrial Drive
Findlay, OH 45840
T: 567-525-4924
eric.short@simona-pmc.com

Dan Sproles
Sproles Business Consulting
5210 Canton Street
South Bend, IN 60071
T: 574-747-7997
dan@sprolesbusinessconsulting.com

Paul Uphaus
Primex Plastics
4164 Lake Oconee Drive
Buford, GA 30519
T: 1.800.935.9272
puphaus@primexplastics.com

PROCESSING COMMITTEE

Jim Arnet (Chair)
Hagans Plastics Co.
121 W. Rock Island Road
Grand Prairie, TX 75050
T: 972.974.3516
jarnet@hagansus.com

Robert Browning
McConnell Company
P.O. Box 450633
Atlanta, GA 31145
T: 770.939.4497
robert@thermoformingmc.com

Bret Joslyn
Joslyn Manufacturing
9400 Valley View Road
Macedonia, OH 44056
T: 330.467.8111
bret@joslyn-mfg.com

Stephen Murrill
Profile Plastics
65 S. Waukegan
Lake Bluff, IL 60044
T: 847.604.5100 x29
smurrill@thermoform.com

Jay Waddell
Plastics Concepts & Innovations
1127 Queensborough Road
Suite 102
Mt. Pleasant, SC 29464
T: 843.971.7833
jwaddell@plasticoncepts.com

Steve Zamprelli
Formed Plastics, Inc.
297 Stonehinge Lane
Carle Place, NY 11514
T: 516.334.2300
s.zamprelli@formedplastics.com

DIRECTORS EMERITI

Lola Carere
302 Sable Trace Ct.
Acworth, GA 30102-7617
T: 770.883.7055
carerelola@comcast.net

Richard Freeman
Freetech Plastics Inc.
2211 Warm Springs Court
Fremont, CA 94539
T: 510.651.9996
rfree@freetechplastics.com

Steve Hasselbach
CMI Plastics
222 Pepsi Way
Ayden, NC 28513
T: 252.746.2171
steve@cmiplastics.com

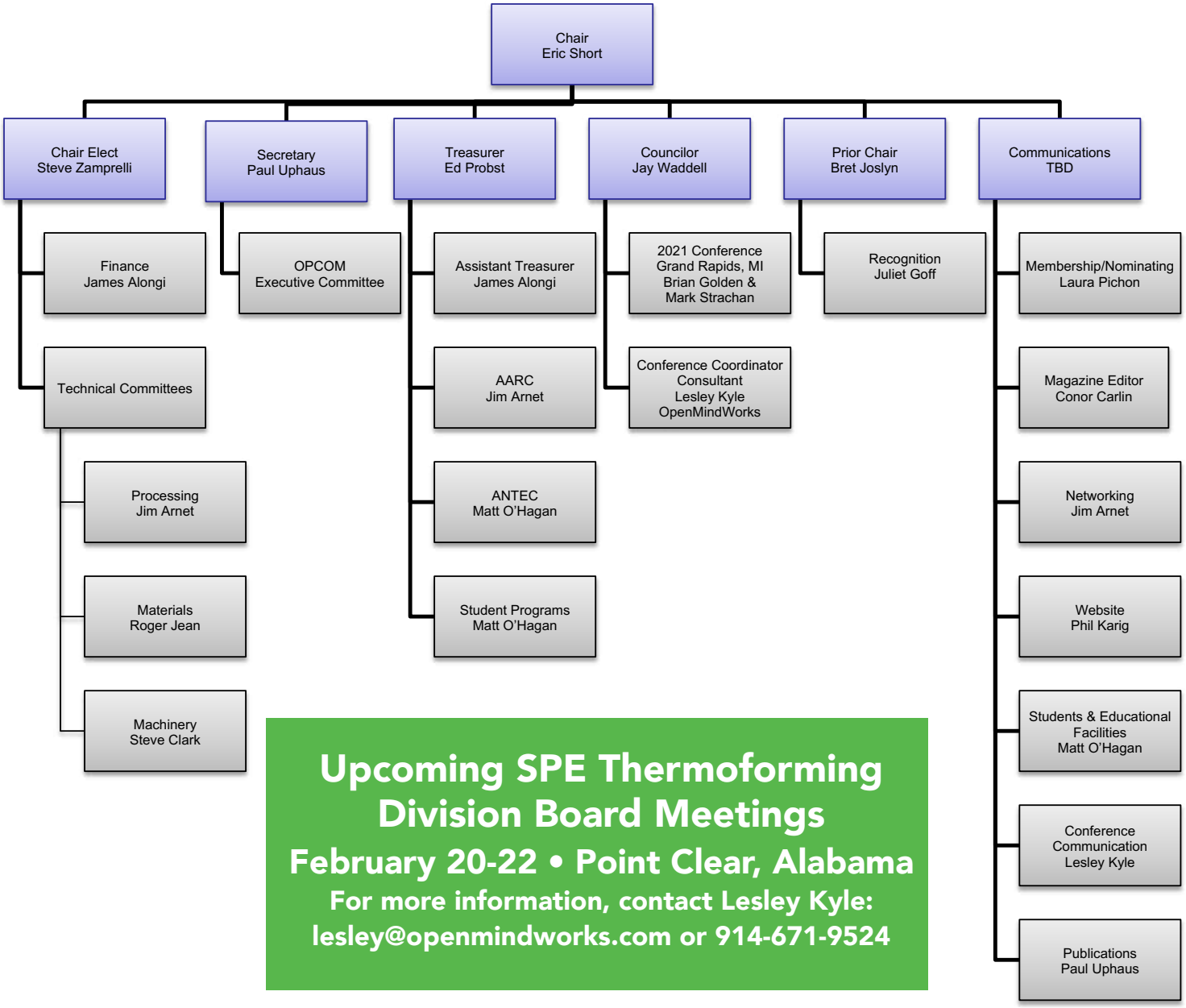
Donald Hylton
McConnell Company
646 Holyfield Highway
Fairburn, GA 30213
T: 678.772.5008
don@thermoformingmc.com

Roger Kipp
Roger C. Kipp Consulting
3C Owens Landing Court
Perryville, MD 21903
T: 717.521.9254
srkipp@msn.com

Gwen Mathis
6 S. Second Street SE
Lindale, GA 30147
T: 706.346.2786
gmathis224@aol.com

Why Join? **It has never been more important to be a member of your professional society than now, in the current climate of change and global growth in the plastics industry. Now, more than ever, the information you access and the personal networks you create can and will directly impact your future and your career. Active membership in SPE – keeps you current, keeps you informed, and keeps you connected. Visit www.4spe.org for details. The question really isn't "why join?" but ...Why Not?**

2019 THERMOFORMING DIVISION ORGANIZATIONAL CHART



Upcoming SPE Thermoforming Division Board Meetings

February 20-22 • Point Clear, Alabama

For more information, contact Lesley Kyle: lesley@openmindworks.com or 914-671-9524

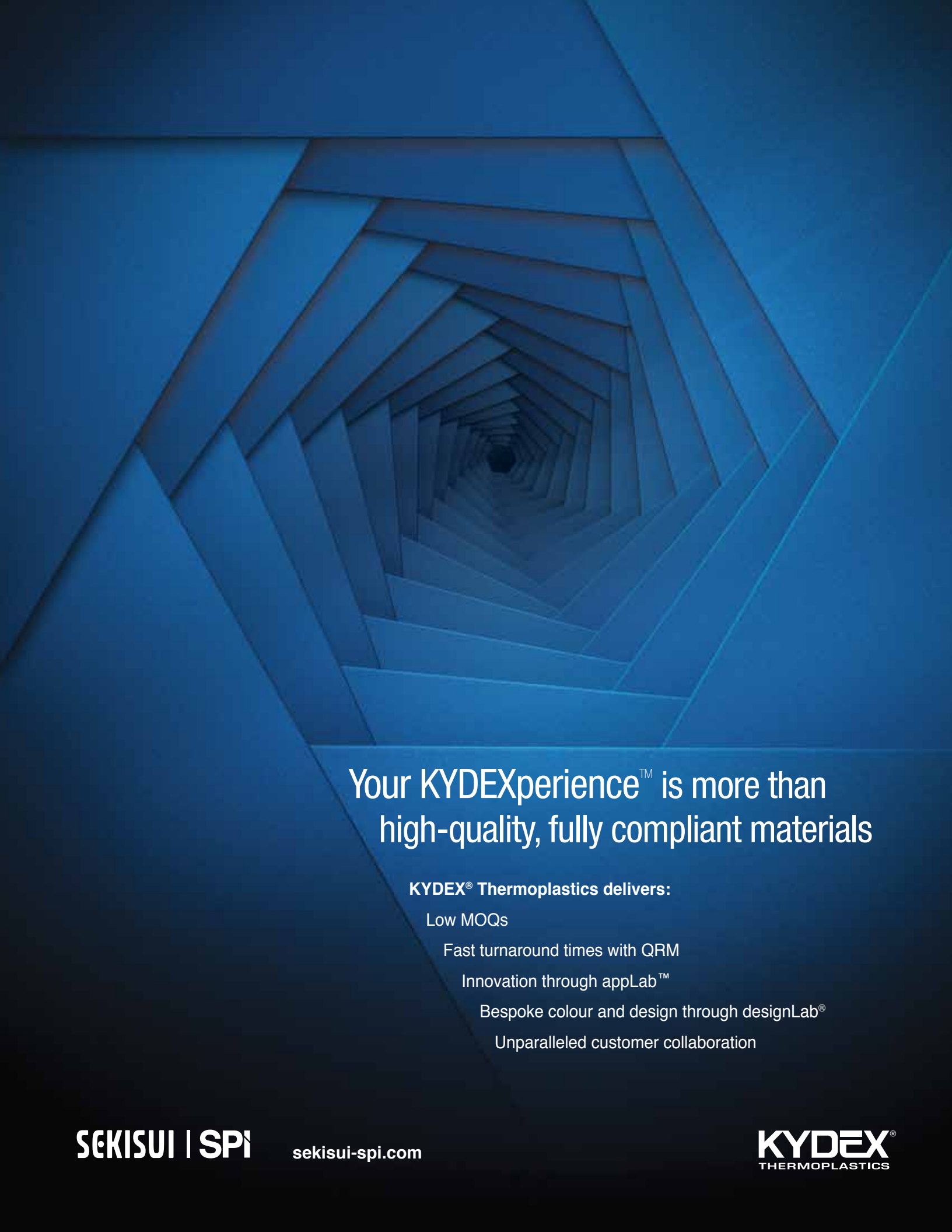
Thermoforming Division Membership Benefits

- Access to industry knowledge from one central location: www.thermoformingdivision.com.
- Subscription to Thermoforming Quarterly, voted "Publication of the Year" by SPE National.
- Exposure to new ideas and trends from across the globe.
- New and innovative part design at the Parts Competition.
- Open dialogue with the entire industry at the annual conference.
- Discounts, discounts, discounts on books, seminars and conferences.
- For managers: workshops and presentations tailored specifically to the needs of your operators.
- For operators: workshops and presentations that will send you home with new tools to improve your performance, make your job easier and help the company's bottom line.

Join today!

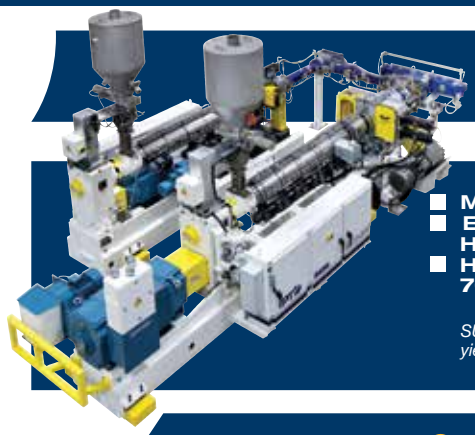
Sponsor Index

These sponsors enable us to publish *SPE Thermoforming Quarterly*


Your KYDEXperience™ is more than
high-quality, fully compliant materials
KYDEX® Thermoplastics delivers:
Low MOQs
Fast turnaround times with QRM
Innovation through appLab™
Bespoke colour and design through designLab®
Unparalleled customer collaboration
SEKISUI | SPI
sekisui-spi.com
KYDEX®
THERMOPLASTICS

EXTRUSION SYSTEMS

LEADING TECHNOLOGY



SUPER G® HighSPEED™

- MULTI-RESIN SOLUTION (PET, HIPS AND PP)
- ENERGY EFFICIENT (PET 9-10+ PPH/HP, HIPS 8-9+ PPH/HP and PP 6-7+ PPH/HP)
- HIGH THROUGHPUTS (1,500 – 3,500+ PPH, 700 – 1,600+ KG/HR)
- ULTRA HIGH REGRIND RECOVERY RATES (+80%)
- EXCELLENT MELT QUALITY
- AVAILABLE WITH ALL PTI ROLL STAND CONFIGURATIONS

SUPER-G® HighSPEED™ extruders offer "High Density Manufacturing" solutions that yield high production outputs with small machinery footprints.

HVTSE® DryerLESS™

- MOISTURE REMOVAL CAPABILITY 12,000+ PPM (1.2+%)
- ENERGY SAVINGS REALIZED 35+%
- TRUE MULTI-RESIN CAPABILITY (PET, PLA, PS, PP, ...)
- EXCELLENT MELT QUALITY & LOW MELT TEMPERATURES
- MONO OR CO-EXTRUSION CONFIGURATIONS AVAILABLE
- ROLL STOCK OR INLINE SOLUTIONS

DryerLESS™ PET/PLA sheet extrusion demands a robust production solution. PTi's HVTSE® (High Vacuum Twin Screw Extrusion) provides this and more!

G-SERIES® QuadPLUS™

- MEZZANINE CO-EXTRUDERS/ COMPACT MACHINE FOOTPRINT
- HIGH RATES OF PRODUCTION/ MANY SIZES AVAILABLE
- TITAN® CONTROLS AUTOMATION FOR EASE OF OPERATION
- MULTI-RESIN PROCESS CAPABILITIES (PP, PS, HDPE,...)
- QUAD CUP, SIDE X SIDE, BARRIER & STRIPE CONFIGURATIONS
- SEVERAL ADVANCED OPTIONS TO CHOOSE FROM!

PTi's 4-layer G-SERIES® Quad Cup 4 extruder co-ex complex, mezzanine mounted co-extruders, & Model G-SERIES® GCVD661824 with dual auxiliary cooling rolls

G-SERIES® VERTICAL

G-SERIES® Vertical roll stands offer process flexibility for a wide range of applications.

G-SERIES® HORIZONTAL

G-SERIES® horizontal roll stands provide an excellent solution for thin-to-medium gauge applications.

G-SERIES® J-STACK

G-SERIES® J-Stack roll stands are well suited for high output medium-to-heavy gauge processes.

SUPER-G® MultiNIP™

SUPER-G® MultiNIP™ roll stands uniquely permit ultra low orientation for lay flat thin-to-medium gauge processes.

PTi®

World Class Sheet Extrusion Systems

www.ptiextruders.com

MADE IN U. S. A.

Processing Technologies International, LLC | 2655 White Oak Circle Aurora, IL 60502 | Tel: 630.585.5800 | Fax: 630.585.5855