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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

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It is already May, though for many of us across the Midwest and East Coast of North America, warmer temperatures have been elusive. Weather is something that affects us all in various ways. Many of us have family or colleagues who were affected by the floods in the Great Plains this year, or by the hurricanes which devastated parts of the US last year. Compounding these natural disasters are images of debris, both plastic and non-plastic, in many waterways. Here in the US, and in other developed countries with strong infrastructure, we do not always think about the impact of plastic pollution on our environment. Yet it is a fact that our municipal waste management systems are easily overwhelmed during periods of severe weather, causing havoc for local ecosystems. And though we are now very familiar with the rivers of trash emanating from discrete areas in South East Asian countries, we cannot assume that we don’t have work to do at home.

When it comes to plastic materials and the environment, PLA is often mentioned as both a suitable alternative to fossil-based plastics and an environmentally responsible choice due its ability to biodegrade in certain conditions. This issue of *Thermoforming Quarterly* offers readers a closer look at developments in PLA, specifically on heat resistant blends that are finding favor in markets such as coffee capsules (see pp. 26-27).

Innovations in resins and extruded sheet lead to new technological solutions that are primed for commercialization. Increasing demands in customer applications raise the bar and drive innovation in materials and machinery. This is the relentless push and pull of market forces on a healthy industry. In our *Innovation Briefs* section, we review a new UV technology that is used to detect the presence of clear plastic sheet during thermoforming (see pp. 20-24). And yet with so many variables in our favorite process, it is evident that we can still push our levels of knowledge through a deeper understanding of critical factors such as crystallinity and orientation. Dr. Amit Dharia presents a summary of his most recent tests on clear PET cups (see pp. 16-20), reminding us that it is just as important to “know why” as it is to “know how”.

The Board of Directors recently met in Austin, TX to continue work on the 2019 Conference program, details which will be released shortly. Our May meeting is also when we elect the new “Thermoformer of the Year”. You will find a brief press release in our “News” section, but our tradition states that we celebrate our winner in our Q3 Conference Edition of the magazine with an in-depth article and photo.

For now, I wish you all the warmth that the summer season will (hopefully!) bring, and I look forward to welcoming everyone to Milwaukee in September for the annual conference.
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Graham Partners Acquires Fourth Thermoforming Company

By PlasticsToday Staff

April 11, 2019 — Graham Partners (Newtown Square, PA) has scooped up another thermoforming company, its fourth acquisition in this space. The private equity firm focused on industrial technology and advanced manufacturing companies announced the acquisition of James L. Villa Inc. (Oldsmar, FL) on April 10. This follows the acquisition of platform company EasyPak near the end of 2017 and subsequent add ons Tray-Pak Corp. and Nuconic Packaging LLC.

Graham Partners said that it considers thermoformed packaging to be an attractive niche market that is benefiting from increasing consumer demand for sustainable packaging options and freshly prepared, on-the-go meals.

James L. Villa is a third-generation family owned and operated business that specializes in custom thermoformed and injection molded packaging for fresh food products in supermarkets. The addition of that business will enable EasyPak to strategically expand into the southeast while providing additional customization capabilities and scale to EasyPak’s business, said the company.

“James L. Villa boasts an impressive roster of loyal, long-term customers in the grocery channel,” said Dave Furstoss, CEO of EasyPak, adding, “we are excited to partner with the business to expand our thermoformed platform presence in the southeast.”

“We initially acquired EasyPak with the intention to build a top-tier mid-sized thermoformer,” said Steven Graham, CEO of Graham Partners. “With three subsequent complementary acquisitions completed to date, we are well on our way to achieving this vision.

Investment Group Buys Alabama Thermoforming

By Bill Bregar, Plastics News

May 10, 2019 — An investment group acquired Birmingham-based thermoformer Reliable Formed Plastics LLC on May 3. Terms were not disclosed.

The five-member investment group includes company founder Rick Turman, who will remain with Reliable Formed Plastics as president. New team members include Finance Director Michael Orme and Operations Director Matthew LePere.

Reliable Formed Plastics does vacuum forming, mold fabrication, computer numerically controlled routing and design and engineering. The company employs 10, Orme said.

The thermoformer makes parts for a range of industries, including aerospace, food and beverage, retail, marine, technology, health care and general industry. Reliable Formed Plastics plans to further diversify service and material offerings while obtaining manufacturing certifications such as ISO9001 and ASA9100.

The company also wants to expand its presence in the aerospace industry, given its proximity to manufacturers in Alabama and the Southeastern United States.

SPE Names Thomas Haglin as Thermoformer of the Year

May 6, 2019 — The Society of Plastics Engineers (SPE) Thermoforming Division has named Thomas Haglin as its Thermoformer of the Year for 2019.

Haglin is CEO and owner of Baxter, Minn.-based Lindar Corp., a diversified thermoforming company that he founded in 1993. Haglin is also CEO and owner of Avantech, a producer of tooling for rotational molding, acquired in 2012 by Mr. Haglin and relocated to Baxter
in 2016. Lindar employs approximately 175 workers in its 165,000-square-foot manufacturing facility; the company operates nine roll-fed machines, eight sheet-fed formers, six CNC routers, four robotic routers, one label line, and one extrusion line. Its annual revenues exceed US$35 million, SPE said in a statement.

“[Lindar Corp.] has been a pioneer in packaging for individual cupcakes and desserts, tamper-evident two-piece pie and cake containers, bioplastic packaging, and lenticular lenses for 3D-like packaging effects,” SPE said. “In its annual parts competition, the Thermoforming Division of SPE awarded gold medals to Lindar Corp. in 2010 and 2014.”

A native of Brainerd, Minnesota, Haglin received a bachelor’s degree in management from the College of St. Scholastica in Duluth, Minn. He began his professional career in 1985 with Larco/Acrometal, where he was promoted to plant manager.

“Tom Haglin embodies the true spirit of the American Dream, from growing a small acquisition over 25 years ago into a thriving, diversified processor to his broad community service,” said Eric Short, SPE Thermoforming Division Chair. “Our industry is fortunate to have Tom Haglin, and we’re honoured to have him as this year’s SPE Thermoformer of the Year.”

The award will be presented during SPE’s Thermoforming Awards Dinner, held in conjunction with the 27th SPE Thermoforming Conference. The conference will take place September 9-11, 2019 in Milwaukee at the Wisconsin Center and the Hilton Milwaukee City Center Hotel. The Awards Dinner will be held on Tuesday, September 10.

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THE SPE THERMOFORMING DIVISION HAS A NEW PROGRAM TO SUPPORT STUDENT INNOVATION!

This design competition will culminate in a race to the finish at this year’s conference.

- Entrants will be supplied with a sponsor-furnished electric radio-controlled car.
- Entrants must design, manufacture and decorate the car body to be mounted on the chassis. Modifications to the chassis/motor are not permitted.
- The car body must be formed using clear plastic: PET, PETG, Acrylic or Polycarbonate. The body must be produced using the vacuum/thermoforming process. Cars will be judged for presentation and thermoforming complexity. The only design limitation is your creativity!
- Students may participate as individuals or in teams. Each entrant is required to submit an article on their RC Car project for publication in *SPE Thermoforming Quarterly™* magazine.
- Entrants will race each other on an indoor race track at the conference in Milwaukee.
- Student participants may qualify for travel expense support based on need.
- All participants - regardless of race placement - will keep the RC Car they designed. Winners will receive cash prizes.

At press time, 10 schools were enrolled in this year’s competition. Qualifying heats will take place on September 10 and 11, and the final race will be run on the afternoon of September 11 on the show floor.

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Lessons from 70 Years of Thermoforming

By Brian Ray, Ray Products
Ontario, California


A team of Credit Suisse analysts announced that the average lifespan of a company today is less than 20 years. We’ve certainly made our share of mistakes over the years, but I feel like our longevity speaks to the fact that we’ve gotten it right more often than we’ve gotten it wrong.

With that in mind, I thought I’d take our anniversary as an opportunity to look back and find themes in the things that have driven our company’s success through the past seven decades.

Treat Your Industry as Colleagues, Not Competitors

I grew up at Ray Products, sweeping floors and filing papers. I listened to my father and grandfather talk about their challenges and successes around the dinner table. But it wasn’t until I’d earned a degree in Business Administration and spent a few years working outside the family business in tech and marketing that I was ready to come back to Ray Products.

When I did, in 1993, I was shocked at the welcome I received from outside the company. I got a flood of calls, notes and emails from suppliers, customers and even competitors. They all had the same theme: “Welcome to the business, Brian. We’re glad you’re here, and if you ever need anything, I’d be happy to help.”

This is not a normal reaction to joining a company, and I attribute it to two factors. The first is the sense of camaraderie that exists in our industry. Thermoforming is a niche within the plastics industry, and in my entire career, I’ve seen more support from competitors than ruthless competition. That’s an attitude I believe serves us all.

The second and more relevant factor was my father’s attitude towards the people he dealt with every day. Bruce Ray was the very definition of a people person. He genuinely cared about every person he met. It showed in the way he treated his employees, his suppliers and even his competitors.

During his tenure, my father had no less than three employees who left Ray Products to start their own competing thermoforming plants. Most business owners would see this as a profound betrayal. My father saw it as a sign of his success. He didn’t go after them; he supported them. He helped them get going.

It seems counterintuitive to support your competitors. But what I learned from my father is that it can make a whole lot of sense. Sure, we may have referred out jobs to competitors that we could have handled in-house, but we’ve also had competitors refer work to us. We’ve given advice that may have made our competitors more competitive, but we’ve also learned from them.

I can’t match my father’s reputation for being a people person, but I do try and emulate the collegiality he displayed every day. I think it’s a model that any leader would be smart to follow.

Focus on Your Strengths, Know Your Weaknesses – As a Corporation

My first real role at the company was in sales. That gave me the opportunity to really get to know our customers and operations. In fact, I spent my first few months at Ray Products doing exactly that. Through that process, I began to face the fact that while there were many areas where we excelled, there were also other areas where we needed improvement.

It’s tempting, when you’re in a leadership role, to ignore areas where your company might be failing. It can, for some personalities, be equally tempting to gloss over areas where you’re really succeeding. The most productive strategy is to be honest about both. As I moved into more of a leadership role, I had opportunities to highlight our strengths and to deal with our weaknesses.

In my experience, there are two ways to deal with a company’s weaknesses: fix them or adjust your business model. We’ve done both. When I came to the company in 1993, our workforce had fallen behind the tech curve in...
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business operations. We had a Wang Mainframe that was still spitting out reports. At some point, we’d invested in desktop computers for the entire office staff, but a good chunk of them had never been turned on.

There’s certainly value to tradition, but we were missing out on a lot of opportunity. We took the time to show our workforce the value of integrating technology into their workflow and the opportunities it gave them. In just a few years, our business operations went from being technically outdated to being at the forefront of technology solutions.

Around the same time, I also realized we were sometimes saying “yes” to jobs that weren’t a good fit for our company. During my grandfather’s era, and to a lesser extent my father’s, we were a young company. Any opportunity was a growth opportunity, so we said “yes” and figured out “how” later.

By the time I took on a leadership role, however, we’d found our niche. We knew the areas where we could compete well against other processes; we knew the areas where we could compete well against other thermoformers; and we had a pretty good idea of which types of jobs were profitable and which types of jobs were not.

I had to learn when to say “no,” and I had to teach our entire team when it was appropriate to say “no”. Or, more accurately, “No, thank you.” One of the things I’ve worked to ingrain in our team is that we never send away someone who brings us an opportunity that isn’t the right fit out the door without trying to help them along the way. At the very least, we’re leaving a good impression, and quite often we’re sowing the seeds of future business.

**Focus on Your Strengths, Know Your Weaknesses – As an Individual**

Despite being three generations of the same family, my grandfather, father and I are very different people, with very different strengths.

My grandfather’s strength was as an engineer. He was absolutely in his element experimenting with new processes, methods and materials, and figuring out things that no one else could. During his era, much of Ray Products’ strength was in being able to do things that no one else could do, or do them better than anyone else could.

My father’s strength, as I mentioned earlier, was in people and relationships. Mine is in understanding our customers and their needs.

The flip side is that to be effective in our roles, all three of us have had to find people to fill roles where we were not as strong. I can very effectively lead the customer-facing parts of our business. Sales and marketing are in my wheelhouse. On the other hand, it’s been critical that we find and retain talented people in engineering and manufacturing leadership roles where I wouldn’t be strong.

It’s important that leaders understand every aspect of their business, but it’s equally important for effective leaders to focus on the areas where they can deliver the most value, and let others take on leadership roles in areas where they can deliver more value.

**Make Sure that Institutional Knowledge is Shared**

Even in an employment market where changing jobs frequently has become the norm in many sectors, I still see value in being an employer that can foster long-term loyalty. During my tenure as company president, we’ve had two employees retire after 50 years of service to the company.

In an environment with low turnover, it’s easy to think, “Oh, that’s his or her area. I don’t need to know that.” The more every employee understands about the entire business, the more they’re able to contribute to that business’s success.

Does the person running the thermoforming machine need to understand what’s going on with your sales team? Not necessarily, but if they do, I can promise you from experience that things will go more smoothly. If your manufacturing team knows the application, concerns and goals of the products they’re making, they’ll be able to better realize these goals. If your customer-facing teams understand the processes you provide, they can offer better solutions to your customers.

If you’re creating silos for knowledge and skills in a single employee or a single department, you’re missing out on opportunities for cooperation and cross-pollination.

**Don’t Let Yourself Become Stagnant**

For better or worse, changes in leadership often drive change within companies.

When my grandfather started Ray Products in 1949, he was reacting to an opportunity he saw for new technologies and the need for new products in the marketplace. When my father took over in 1975, I have no doubt that he saw things that needed to change. When I took over in 2003, I saw real opportunities for growth and advancement.
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That said, I’m confident that one of the key reasons we’ve been around so long is that none of us have been satisfied with the status quo. My grandfather was constantly innovating, developing new techniques and improving existing ones to deliver new and better products.

Even though the industry had matured significantly by the time my father took over, he added new capabilities and lines of business throughout his tenure and led our expansion into a new facility that more than doubled our size 20 years into his tenure as president.

In my leadership, I’ve tried to emulate them with a constant push for growth and advancement in our operations and services. I firmly believe that many companies fail because they reach a certain level of success and then stagnate while the competition passes them by. Don’t let your comfort make you complacent.

Don’t Give Up

It’s easy to look back on our 70-year history through rose-colored glasses. But when we have challenges today, it’s comforting to remember that my father and grandfather took their lumps as well.

For my grandfather, there were many times when the company’s success or failure hinged on a single decision. I can’t imagine how many times he more or less “bet it all on black.” As a boy growing up during my father’s time as president, I remember conversations about oil crises and my father wondering if they’d be able to get the materials the company needed to fulfill orders.

Most of my sleepless nights have been around wondering if a major investment we’ve made in technology or equipment would pay off, or whether I’ve just wasted a tremendous amount of money on something that wouldn’t work.

We’ve all had good years and bad years, investments that paid off and investments that didn’t. If you want to build a thermoforming company that’s in it for the long term, my advice is to take your lumps, learn from them, then move on to embrace your next opportunity.

Here’s to the next 70 years – for all of us.

About the author

Brian Ray is President of Ray Products, a California-based heavy gauge thermoformer, specializing in pressure forming precision parts and enclosures for medical devices, transportation, electronics and other demanding applications.

Ray Products has been manufacturing high-quality 3D thermoformed plastic parts since 1949. Located in Ontario, California, Ray Products uses the most advanced machinery and materials in the business to create custom plastic pieces used in medical equipment, transportation, green energy, automotive, building and construction, recreational equipment, and more.
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Maximizing Crystallinity and Clarity of Plug-Formed PET Cups via Change in Forming Conditions

Amit Dharia, PhD., Transmit Technology Group, Irving, TX

In this study, the effects of process parameters and tool materials on % crystallinity and transparency of PET cups are examined using Technoform Thermoformability Test equipment.

Introduction

Poly(ethylene terephthalate), PET, is used in making clear, deep-drawn thermoformed cups and trays where it competes with clear PS and clarified or nucleated PP.

PET is a semi-crystalline polymer with a maximum of 40% crystallinity. Its crystallinity changes both with the type and amount of co-monomer and rate of cooling (1). The rate of crystallization of PET is so low that quenching or rapid cooling can result in totally amorphous and transparent APET while heat treating PET above its glass transition temperature (Tg) for a few hours can produce crystalline and opaque CPET. A large amount of amorphous content makes PET tougher compared to CPP, but not as stiff as GPPS. Even though the melting point of PET is close to 260°C / 500°F, due to its lower Tg, it does not have the same stiffness as PS at elevated temperatures (2). Due to its low crystallinity, it thermoforms better than CPP but not as well as PS.

When heated, PET exhibits a secondary (cold) crystallization at around 120°C / 248°F. Therefore, it needs to be thermoformed above 120°C / 248°F. It begins to crystallize rapidly around 170°C / 338°F and cannot be formed. Once it approaches 190°C / 374°F it begins to lose melt strength. So, a typical forming temperature range for PET is 120°C to 170°C (248°F to 338°F).

The density of PET changes significantly with crystallization. The density of APET is 1.335 g/cm3 as compared to 1.455 for 100% crystallized PET. If a part is quenched, crystallization continues at a slow rate resulting in shrinkage and warpage. If it is cooled slowly using a hot tool, it crystallizes and becomes opaque and brittle. So controlling the heating and cooling rates is critical in controlling drawability, clarity, crystallinity, and demolding.

On one hand, high crystallinity is desired as it improves strength, stiffness, temperature resistance, top load (or crush resistance) and gas barrier properties. On the other hand, high crystallinity reduces clarity and toughness. Balancing clarity while achieving maximum possible crystallinity is desired.

The crystallization rate can be controlled by controlling the temperature or by adding nucleating agents such as TiO2 or sodium stearate, plasticizer like glycerol or oligomers (3). A small amount of oligomers and comonomer can increase crystallization rate and crystallization temperature, Tc. Nucleating agents enhance crystallization rate, crystallization temperature (Tc) but they do not increase the overall crystallinity. Most nucleating agents also have adverse effects on molecular weight, melt viscosity, and clarity.

It is essential to control the heating rate and overall crystallinity before forming. If the crystallinity is too low, the sheet sticks to the mold. If it is too high, the sheet will be too stiff to form and it will shrink and tear. PET absorbs heat in two frequencies. A lower heater temperature and a longer heating time is better for thick sheets, and a higher temperature and faster heating in case of thin sheets. If crystallinity is higher than 5% after heating, the material begins to turn opaque before it is indexed into the forming station. Once crystallization begins at around 120°C / 248°F, it occurs rapidly.

Crystallization rate and overall crystallinity can be controlled by adjusting the cooling rate or by inducing strain. Orientation results in strain-induced crystallization and is used in fiber production (4,5). Due to its slow crystallization rate and higher amorphous content, PET can be oriented easily, and the degree of orientation can be controlled more effectively. So, to produce clear, deep-drawn PET parts with higher crystallinity, bi-axial orientation is preferred. The goal is to produce as high a level of crystallinity as possible while maintaining transparency.
In thermoforming, the degree of orientation-induced crystallization can be modified by adjusting the thermoforming temperature, forming speed and tool temperature.

**Experimental**

A 0.9 mm (30 mils) thick APET transparent roll-fed sheet was thermoformed at temperatures ranging from 120°-160°C (248°F - 320°F), plug speeds from 150 to 250mm/sec, using two types of cup shape plugs with 72 mm top diameter, 50mm bottom diameter, and 118mm height. Two hollow plugs were made of HYTAC-B1X syntactic foam material and stainless steel. The sample diameter was 75mm and the draw depth was 50mm. The resulting area had a draw ratio of 2.69:1 and the linear draw ratio was 3.83:1. Three samples were formed to stabilize temperatures before collecting test samples.

Samples were heated by two 1000 w/m² quartz heaters at a distance from the surface of the sheet. The top heater was set at 650°C / 1202°F and the bottom heater at 610°C / 1130°F. The heating time was adjusted to 20s, 25s, and 30s with corresponding forming temperatures (Tf) of around 130°C, 145°C, and 160°C (266°F, 293°F, 320°F).

The time to draw to 50mm draw depth at 150mm/s plug speed is 0.33s, at 200mm/s 0.25s, and 0.2s at 250mm/second. Corresponding strain rates are 8.6 1/s, 11.32 1/s, and 14.1 1/s respectively. Typical industrial thermoforming occurs in strain rate the range of 0.1 to 10 1/s.

The temperature of the sheet, force vs. draw depth during forming, and force vs. time during cooling were collected and plotted. A DSC test was performed at 10 C/minute rate on 10-12 mg sample taken from the center of the wall of the thermoformed cups. The percentage crystallinity was determined from the net heat of melting (difference between enthalpy of melting Hm2 and cold crystallization enthalpy Hm1) considering the Hm for 100% crystalline PET to be 141 j/g.

**Results and Discussion**

Figure-1 shows thermoformed cups. Table-1 shows experimental conditions, forming temperature Tf, sag distance, force at various draw depths and the ratio of forces (Fd/Ff) at the end of cooling to end of forming. Table-2 shows the DSC test results. Figure-2 shows the force during forming vs. draw depth. Figure-3 shows the temperature vs. draw depth, and Figure-4 shows force during cooling and Figure-5 shows the temperature vs. cooling time.

<table>
<thead>
<tr>
<th>Speed mm/s</th>
<th>Plug</th>
<th>Heat ET sec</th>
<th>Tf°C</th>
<th>Sag</th>
<th>Dwell Sec</th>
<th>F10 KgF</th>
<th>F20 KgF</th>
<th>F30 KgF</th>
<th>F40 KgF</th>
<th>Fd/Ff</th>
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Table 1: Experimental Conditions and Force to Form
As can be seen, the clarity of cups varies with forming conditions. Typically, between Tg and Tm the sheet is in the rubbery stage. The required force to form the plastic increases with an increase in the draw depth. The force to form increased with increasing temperatures from 130 to 160°C (266 - 320°F). At 160°C / 320°F and slow plug speed, the part did not form to the full 50mm depth. The residual force as indicated by the ratio of force after the part cooled to force at the end of forming (Fd/Ff) increased with sheet temperature and plug speed. The ratio was 0.73 at 160°C (320°F) vs. 0.14 at 130°C (266°F).

This ratio is a measure of shrinkage. This is because the part crystallized more at higher temperatures and speed.

As shown in Table-2, the percentage crystallinity for APET sheet before forming was 8%. After forming, it varied from 6% to 28%. At a low forming temperature of 130°C / 266°F, the cups formed using HYTAC B1X plugs were transparent. The % crystallinity increased from 9 to 11% with an increase in plug speed from 150 to 200mm/seconds. Higher plug speed should increase the cooling rate and decrease the % crystallinity. So, an increase in crystallinity upon increasing plug speed is due to strain-induced crystallization. With an increase in temperature from 135° to 145°C (275 - 293°F), at 150mm/second plug speed, the cup became translucent and hazy. At 160°C / 320°F, the crystallinity increased to 24-28% and the parts turned semi-opaque to opaque and did not form fully. They also required much higher force to form. At 135°C / 275°F, the cup formed using a stainless steel mold at 150 mm/second plug speed had the same level of crystallinity, 11%, as the cup formed using HYTAC B1X, but at 200 mm/second the percentage crystallinity of the part formed using the steel plug increased to 21% and the cup was still transparent. This is because sheet cools at slower rate in contact with a steel plug than with a syntactic plug. Thus, a clear part with higher crystallinity was obtained at a forming temperature of 135 C and 200 mm/second plug speed using a stainless-steel mold.
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Figure 5 shows the temperature vs time during cooling. For parts which were transparent and had higher crystallinity, they also had a temperature closer to the Tg of PET. The orientation is reversible at higher temperatures, so the temperature after cooling and demolding should be low to freeze orientation.

### References


5. (Out Of Plane Orientation And Crystallinity Of Biaxially Stretched Polyethylene Terephthalate, Sudheer Bandla, Masoud Allahkarami, and Jay C. Hanan, Advances in X-ray Analysis, Volume 57.
Overview

ThermaPANEL is a hydronic, modular heat transfer system for heating and cooling exterior and interior environments and surfaces. It is primarily used for highly efficient snow melting of pedestal- and ground-mounted pavements and for collecting solar energy to heat swimming pools while cooling the pool patio, something not achievable with tube-based systems.

Features and Benefits

The ThermaPANEL units are twin-sheet thermoformed using PE-RT plastic on a shuttle-type thermoformer with production molds allowing for the creation of a multi-channel panel with flow turbulence stanchions and inlets that allow for even, turbulent flow of the hydronic fluid throughout the modular panel. The result is an enhanced, conductive, or radiant heat transfer between the panel and any surface with which it is in contact.

The .110” material is extruded into individual sheets and is corona-treated on one side to allow for better adhesion of the PSA adhesive that holds 1” of EPS insulation to the bottom of the panel.

The temperature-controlled tooling forms an inlet and outlet near the center of each panel allowing for the secondary process of the socket fusion connection of 1/2” PE-RT “S” shaped tubes between the panels which in turn create foldable rows of pre-assembled panels up to 50’ long. The socket fusion process rounds out the imperfectly thermoformed inlets.

After forming, the panels are cooled to a specific temperature allowing for a pre-determined shrink ratio and then trimmed on a 30 ton stamping press with a 3D die. The design of the cutting die was critical for trimming around the inlets while allowing for a variance in size due to shrink.

A proprietary pressurized testing unit had to be created in order to be attached and sealed to the roughly formed inlets. After trimming, the panels are immediately pressure and heat tested in ovens providing the thermoformer with immediate results for quality control.

The thermoforming, cooling, stamping, testing and re-grind process are performed by one person.

An automatic loading double-end thermoformer is being built to cut production cycle time by more than 60%. |
C23 Sensors with UV Light Source

Transparent-object sensors with patented UV technology detect presence of clear plastic sheet during thermoforming

By Yves-Alain Gubler, Global Product Manager, Contrinex

During automated packaging, high-speed thermoforming lines produce transparent plastic blister-trays from continuous reel-stock material. Transparent-object sensors with patented UV technology detect the presence of the transparent plastic sheet as it is unwound, ensuring the material is correctly tensioned as it enters the loading station. False detection is avoided, ensuring reliable operation with little or no downtime. Ecolab-certified, these sensors are also suitable for the packaging of medical products.

**Sensing task**

Thermoforming equipment is often used in the production of plastic packaging and is particularly suitable for the continuous production of blister-packs. The process involves the in-line vacuum-forming of clear thermoplastic material into semi-rigid blister-trays, which are sealed with film once the product has been inserted. Configurable thermoforming lines are ideal for the high-speed production of such blister-trays from continuous reel-stock material.

Configurable thermoforming line producing blister trays from continuous roll material (source: Contrinex)

Coupling a standalone reel-feeder to the loading station of a modular line is quick and simple. In operation, a set of drive rollers draws thermoplastic sheet from the stock reel, creating a continuous loop of material between the feeder and the loading station. Maintaining the size of the loop between defined limits ensures the material is correctly tensioned as it enters the loading station.

Contrinex sensors ensure that the loop size is kept within defined limits. (source: Contrinex)
Sensors must detect the presence of the transparent material as the loop size varies, initiating or inhibiting operation of the feeder if the loop becomes respectively too small or too large. Photoelectric sensors using visible-light sources are unsuitable as they cannot differentiate reliably between ‘material present’ and ‘material not present’ under normal operating conditions.

**Customer solution**

Contrinex C23 transparent-object reflex sensors with ultraviolet LED-light sources are ideally suited to this application. These small cubic devices, mounted between the reel feeder and the loading station, detect the presence of the transparent material loop as its size varies. Positioning sensors and reflectors is simple thanks to a range of adjustable mounting brackets, and autocollimated optics ensure there are no blind zones.

Contrinex transparent-object sensors utilize a patented reflex operating principle with polarized ultraviolet light at 275 nm. At this wavelength, absorption of the polarized UV light by a range of commonly used plastics is maximized. Custom-designed UV reflectors, using high-tech plastic materials with excellent reflective properties in the ultraviolet range, provide a range of sizes and geometries that simplify installation.

An industry-standard PNP normally open output ensures optimum flexibility. Additionally, IO-Link, a standardized point-to-point serial connection protocol for sensors and actuators, is enabled on PNP versions at no additional cost. A second output provides a stability alarm in the event of reduced sensitivity, flagging the need for preventative maintenance before any performance degradation occurs.

Robust sensor construction, featuring small (20 mm x 30 mm x 10 mm) Ecolab-certified plastic housings with M8 connectors, ensures reliable operation. A sensing range up to 1200 mm, adjustable via a teach button or via IO-Link, accommodates a range of machine geometries. Sensitivity parameters are stored on the sensor’s inbuilt memory and may be retrieved or updated remotely via IO-Link, eliminating the need for manual adjustment.

These rugged sensors meet the customer’s need for reliable operation with little or no manual intervention. The solution is highly cost-effective with minimal non-productive time; throughput is maintained at or above target levels.

**Benefits for the customer**

- UV sensors ensure reliable detection of transparent plastic targets
- Safe detection of the thinnest transparent materials
- Maximum operating reserve owing to high absorption factor of UV light by transparent plastics
- Elimination of multiple switching on a single target
- Reliable operation without the need for manual intervention
- Very low sensitivity to dust, liquid droplets and splashes
- Wide operating range accommodates full range of machine geometries
- Simple one- or two-step teach procedure optimizes initial sensor set-up
- Sensitivity parameters are retrieved or updated remotely via IO-Link
- Stability alarm highlights reduced sensitivity, avoiding unplanned stoppages

*Due to the high signal precision - including on flanks - detection is independent of form factor and geometry. (source: Contrinex)*
Advantages of UV sensors

- Ultraviolet reflex photoelectric sensors for transparent object detection
- Very low sensitivity to target shape
- IO-Link serial-connection protocol enabled on PNP versions at no additional cost
- Pre-taught sensitivity parameters stored on inbuilt sensor memory
- Remote sensitivity retrieval or update via IO-Link
- Highly tolerant of contamination by dust, liquid droplets or splashes
- Robust, Ecolab approved sensors with IP67-rated plastic housings

Further information about this topic can be found here: https://www.contrinex.com/product_range/photoelectric-transparent-object-sensors/

About Contrinex

Contrinex is an international sensor manufacturer with headquarters in Switzerland. Due to a far-sighted approach to innovation and advanced technology, Contrinex constantly sets new benchmarks in the sensor world, such as the integration of position sensing into the world of smart factory applications. With over 40 years of experience and the most modern production methods, Contrinex offers a wide portfolio of standard and premium products that lead the field in extreme environments and confined spaces. Innovations developed for the toughest environments also benefit standard sensors, making them more reliable, easier to use and with a performance far beyond market norms. More information can be found at www.contrinex.com.
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Heat Resistant and Home Compostable PLA resins

Kompuestos develops a new Biokomp grade for hot contents

By Grégory Coué. Technical Manager
Kompuestos, Palau Solità i Plegamans, Spain

From soft-drink cups at fast food restaurants and festivals to fresh fruit and vegetable containers: the packaging industry is no stranger to biobased polylactic acid (PLA) plastic. And according to recent studies on the biodegradable plastics market, PLA will maintain its dominance in the biodegradable plastics market through 2023. Made from natural, renewable resources such as sugar cane or corn, PLA is readily available worldwide, processed using conventional converting processes and is recyclable or compostable at the end of life.

However, so far, the use of conventional PLA has largely been limited to applications such as cold food packaging, disposable plates and cutlery and shopping bags. Efforts have been made to develop heat resistant PLA grades able to withstand use temperatures in the range of 80°C to 120°C. Yet these applications all require composting in industrial facilities, while the market is increasingly indicating a preference for home composting.

Other home compostable resins, such as PHA or PBSA, have emerged as alternatives in the biodegradable market, and their market share is expected to grow at a rapid rate. However, although they offer a good fit for flexible packaging and film applications, they lack the mechanical properties required for rigid packaging, in addition to being more expensive.

There is no one-fits-all solution, and the packaging industry is under pressure to offer more sustainable solutions and alternatives to traditional fossil fuel based plastics. As a supplier to some of the largest plastic converters in Europe, Kompuestos® is in a key position to play an influential role in supplying an attractive and sustainable alternative for conventional plastics. Kompuestos is committed to embracing the challenges that the packaging industry is facing.
To withstand high temperatures or with ultra-high barrier properties, as well as that can meet the demands of the growing group of consumers who are aware of the impact of their actions on the environment.

Kompuestos is a Spanish company founded in 1986 in Palau Solità i Plegamans near Barcelona. Over the past three decades, Kompuestos has acquired an in-depth knowledge of the market and has positioned itself as one of the main international suppliers of a large variety of masterbatches, all of which are intended to meet the needs of very diverse markets in the plastics industry, among which the packaging sector. With a production capacity of over 175,000 tonnes per year and growing, Kompuestos has established itself as one of the leading companies in the sector, while still seeking to expand its business horizons.

To answer the demand for greener products, Kompuestos has developed Biokomp, a family of biodegradable and compostable resins made from different starches and other biologically-sourced biodegradable polymers. Several grades of Biokomp for film applications have already been certified by TÜV Austria and have earned the labels OK Compost Industrial, OK Compost Home and Seedling Logo according to the requirements, specified by EN 13432, the reference standard in terms of compostability.

The company is looking forward to expanding its range of compostable solutions through 2019. These products will introduce a new sustainable option to the current challenges of the plastic market and enable customers to develop products that can be recycled at the end of life. Biokomp represents a first essential step towards a circular economy and a responsible production process, as shown by a consistent striving to ensure quality and optimal solutions down the whole value chain.

Kompuestos views the ‘circular economy’ as an economic system that will replace the ‘end-of-life’ concept with a system that calls for a reduction in material use, alternatively followed by the reused, recycling and recovery of materials in production/distribution and consumption processes, with as aim to accomplish sustainable development. This will simultaneously serve to create environmental quality, economic prosperity and social equity, to the benefit of current and future generations.

(Reprinted with permission from bioplastics Magazine)
SPE Council Summary

I recently attended the Spring Councilor’s meeting in Detroit, MI as the Thermoforming Division’s representative to SPE. It was a very good meeting and very upbeat. Included here is a summary of the meeting prepared by Conor P. Carlin, VP Marketing and Communications on the SPE Executive Board.

One of the best parts of the meeting was the new President’s speech. Dr. Brian Landes of Dow is the new President of SPE for 2019-2020. He gave one of the best speeches I have ever heard from an incoming President. He explained why he was a member of SPE and why it was inspiring to him to be a member. The importance of the Society, the information opportunities, the networking and the most important of all, The Society’s relevance and importance in our changing world. He also discussed the two pillars of the SPE Strategic Plan: knowledge and networking.

All of us should all take a moment and look at the reasons why we are members of SPE. Division members have an important role to play in educating the broader public in arenas where scientific knowledge of polymer materials is lacking. We must take the initiative to communicate and educate this public. So how do we do this? Well, the PlastiVan Education program is one way. Our Division (and others) donates to the SPE Foundation for this program. The program needs sponsors who can help sponsor the educational visits to the middle and elementary schools. 21,371 students have attended the PlastiVan presentations. This is a mere drop in the bucket when you consider the entire student population of the United States. For further details, please visit the Foundation on the SPE website to see how you can make a difference.

Another educational avenue is the presentation of technical and informational papers at ANTEC. The Thermoforming Division had only one paper this year for ANTEC. We used to have a full day of papers which would be about 6-8 presentations. A half day was 4. I’m calling on all members to make a renewed effort to ensure that we can get at least 4 papers for next year’s ANTEC. One of our key mission components is education and frankly, we are missing the boat.

When I earlier said the meeting was upbeat, one of the major reasons was the financial report. SPE VP for Finance, Jeremy Dworshak, gave a much improved financial report. ANTEC was more profitable, and SPE achieved a positive operational result. The financial summary is provided here.

SPE is in the process of developing a new fee-for-service schedule to provide support to Divisions and Sections. This would be proposed in lieu of the 12% flat fee (on Division profit) currently in effect. There is a review committee that is working on this and your councilor is part of it. Your councilor is also on the Divisions Committee and the Pinnacle Education Awards Committee. Our Thermoforming Division is fully engaged with our Headquarters.

I appreciate the opportunity to represent the Division. If you any comments, suggestions or items you would like me to bring up the Council, please email at jwaddell@plasticoncepts.com.

The SPE Council meetings were held prior to ANTEC 2019 in Detroit, Michigan. At the beginning of proceedings, President Brian Grady called for a moment of silence to honor the passing of several distinguished SPE members, including Dr. Vicki Flaris, Thoi Ho, Dennis Hvam, and Richard G. Johnson.

All presentations and data discussed during Council meetings are available on The Chain in the Council Committee of the Whole (CCOW). We encourage everyone to take the time to review this information to get a full understanding of the Society.

Financial Review

For 2018, SPE had a net positive operational result, but showed an overall deficit due to lower than expected investment results. SPE management meets on a quarterly basis with investment advisors. January 2019 results were better than budget. SPE is projecting a loss for 2019. Complete details on the 2019 budget are available on The Chain. A summary of the 2018 budget vs. actual report is available below:
SPE Official Business

Councilor Bruce Mulholland presented several proposed changes to bylaws and policies related to the budget review process and Fellows/HSM ratification procedures. Council approved both motions. All changes can be found in the official minutes.

At the end of Council I, President Grady thanked the Executive Board for their service. He also thanked Past President Al-Zubi who is now leaving the Executive Board. President-Elect Landes president the ceremonial pin to Grady and delivered the traditional “Whereas” tribute to Grady.

Incoming President’s Remarks

Dr. Brian Landes of Dow Chemical begins his tenure as President of SPE (2019 – 2020). Dr. Landes delivered an inspiring talk that encouraged all SPE members to reflect upon why they joined the society and what they can do to ensure the society remains relevant and important in a changing world. His presentation included a summary of the SPE Strategic Plan that focuses on twin pillars of knowledge and networking. If SPE is to be vibrant for future generations of plastics professionals, it must make difficult decisions about resource allocation and member engagement. In keeping with the plastics zeitgeist, Landes ended his talk with a short video from The Alliance to End Plastic Waste, a global group that recently dedicated $1.5bn to fight plastics pollution. SPE is uniquely positioned to contribute to this discussion because our strategic plan aligns with what is needed among the broader public audiences where scientific knowledge of polymer materials is lacking. This is the first step in a long journey, Landes concluded.

SPE Foundation

Foundation Director, Eve Vitale, presented a summary of her team’s work over the past year. 21,371 students experienced the PlastiVan in 2018. $88,250 was awarded in scholarships in 2018, with 33 recipients at 21 universities. A scholarship marketing campaign was established in 2018 to increase awareness of the available scholarships in an effort to increase the number of applicants. $64,645 in grants were awarded in 2018, some at events that were not SPE-centric, thereby increasing awareness. “Giving Tuesday” (Tuesday after Black Friday) was a success, raising $8,985 so that 1200 new students can experience the PlastiVan.

Strategic Commentary

ANTEC

The 2018 event, at the time of writing, was projected to achieve ~$300k in profit for SPE. ANTEC 2020 will be in San Antonio, TX with Council starting on the 28th of March and the actual program lasting from March 30-April 2. CSE Farrey announced that ANTEC 2021 will be held in Denver, CO from March 22-25. The public announcement included discussion of the rationale for not co-locating with NPE. Both organizations, SPE and PLASTICS, have achieved a level of success with their respective events that co-location is no longer the optimal arrangement for either group.
SPE Services to Chapters

Sandra McClelland of the SPE Finance Committee presented findings from an in-depth review of SPE staff resource allocation and chapter support requirements. As summarized by CSE Farrey, HQ provides a vast array and quantity of services that consumes a significant portion of HQ staff time and resources. The current fee model (under which some Chapters pay for services and others don’t) is inequitable and unsustainable. Everyone would be better served with a clearer understanding of the services provided and the cost structure. It was decided that a small task group would be assembled to review the issue and bring a recommended revised model forward for consideration. Complete details are available on Leadership Lane.

SPE Sales & Marketing

SPE Business Development Manager, Stephanie Clark, reported on the advertising revenue generated in 2018. In 2019, 79 exhibitors on the floor and 37 are brand new to ANTEC. The total revenue generated from this is $249,000. There are also 6 sponsors generating $75,000. In total, $360,000 was raised against an aggressive budget of $331,990. 26 chapters and organizations have supported student activities in 2018. In 2017, there were $270,087 of advertising sales but since that time, the total has increased to $556,600 in just 1.5 years.

Additional Reports

4 new student chapters have been chartered and approved by Council:

• National Textile University
• University of Oklahoma
• Ontario Institute of Technology
• UC Berkeley

The next Council meeting is tentatively scheduled for November 14-15. Further details will be made available on The Chain.

Respectfully submitted,

Conor P. Carlin
VP Marketing & Communications
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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: 508.771.9400
TravisK@plasticsunlimited.com

Brian Winton
PTi
2655 White Oak Circle
Aurora, IL 60502
T: 630.771.9400
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: 567.525-4924
eric.short@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.o’hagan@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
bret@bret.probstplastics.com

Dan Sproles
Sproles Business Consulting
5210 Canton Street
South Bend, IN 46607
T: 574-747-7997
dan@sprolesbusinessconsulting.com

Paul Uphaus
Primex Plastics
4164 Lake Oconee Drive
Buford, GA 30519
T: 770.935.9272
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

Evan Gilham
Productive Plastics
103 W. Park Drive
Mt. Laurel, NJ 08054
T: 856-717-788-300, x225
Egilham@productivecompanies.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
Jim Armor
Armor & Associates
16181 Santa Barbara Lane
Huntington Beach, CA 92649
T: 714.846.7000
jimarmor@aol.com

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
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