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- Improved PP Thermoformability via PE Layering
- GHG Impact of Biobased PP
- Global Plastics Trends
COMPLETE EXTRUSION SYSTEMS WITH REDUCED LEAD-TIMES

The GENESIS™ Program is a comprehensive inventory of complete extrusion systems compromised of stock machines, parts and sub-assemblies that qualify for expedited delivery. All systems represent current model years and includes PTI’s

The GENESIS™ Program means product availability can be attained far sooner than the customizable options or a just-in-time build and deliver methods. With the potential to substantially reduce ordinary deliveries by over 3 months*, the reduction in lead-time obtained through the GENESIS™ Program would be a contributing factor in expedition of product-to-market and pathway to financial success. Furthermore, each system component of the GENESIS™ Program is backed by PTI’s standard warranty and service agreements, safeguarding investment and reliability now and in the future.

System components include extruders, roll stands, die supports, winders and pelletizers. Individual lines sized by process, sheet specifications and output are available for inline and offline applications.

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NORTH AMERICA

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Hall 16 / D03

November 9 - 10, 2022
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December 6 - 8, 2022
Charlotte, North Carolina
Omni Charlotte Hotel

*Program inventory is replenished as needed and subject to change. Contact PTI for inventory availability and to determine if your project qualifies for the GENESIS™ Program.
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Photo courtesy of courtesy of
At the start of my tenure as Chair of the Thermoforming Division this is my first letter to you, the readers of the Thermoforming Quarterly.

I’d like to say “thank you” to Bret Joslyn, Eric Short, and Steve Zamprelli who demonstrated incredible patience and leadership during probably the most tumultuous 6 years in the Division’s history. Downside events like Hurricane Irma and Covid eliminated 2 of our annual conferences forcing us to think hard about how and what to deliver to our members. But their upside work resulted in reorienting the Board to deliver on the original mission statement of the Division: “......to facilitate the advancement of thermoforming technologies through education, application, promotion and research.”.

This resulted in a healthy reordering of the Board structure and bylaws. Initial efforts have brought out educational webinars, an R&D project testing the viability of the latest tool manufacturing methods, and more opportunities for our industry partners to promote thermoforming. And there is much more to come.

In the meantime your Executive Committee is learning how best to deploy Microsoft Teams to the entire Board to get out of the “email trap” and speed up our work regardless of when our next in-person Board meeting takes place. Who said serving on an all-volunteer professional non-profit was boring?!

As usual Thermoforming Quarterly’s ever capable editor Conor Carlin has teed up great content for you including.........
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C+K Expanding in North Carolina, Adding Solar Power

By Jeannie Reall, Correspondence, Plastics News

August 30, 2022 – Thermoformer C+K Plastics Inc. has moved the Charlotte, N.C., operation it bought last year into a larger facility 30 miles north in Mooresville, N.C., and also is converting that plant and another to solar energy.

Thermoformer C+K Plastics Inc. has moved the Charlotte, N.C., operation it bought last year into a larger facility 30 miles north in Mooresville, N.C., and also is converting that plant and another to solar energy.

C+K added the Charlotte plant last year when it purchased Piedmont Polymers & Fabrication LLC after Piedmont filed for Chapter 11 bankruptcy protection. But the 85,000-square-foot, leased plant had its limitations, and C+K wanted to be able to configure a facility to suit its own needs. So the company bought the 100,000-square-foot Mooresville site and moved July 1, David Grice, vice president of sales and marketing, said in an email.

Grice said C+K bought some new new equipment for the site, which is outfitted for vacuum forming, pressure forming and twin-sheet forming. The company declined to disclose details about the new equipment or say how many jobs were created. Plastics News estimated earlier this year that the Metuchen, N.J.-based company had 20 thermoforming machines and employed 200.

Plastics News also estimated C+K’s 2021 sales at $30 million, placing it at No. 58 in the PN thermoformers ranking. Grice said sales should exceed $35 million this year.

"We will continue to move new business into this facility due to our other two facilities being near capacity," he added.

C+K is spending about $800,000 for the move and equipment, and an additional $1.1 million to convert the Mooresville facility and its third plant, in Conyers, Ga., to solar operations.

The company, founded in 1963, converted half of the energy needs of its Metuchen plant to solar in 2011. At the time, C+K owner Bob Carrier projected annual savings from the conversion at $2.7 million.

As for the current conversions, Grice said, "There will be a saving over time in converting. [The] program worked out very well at the New Jersey facility."

The company expects to complete the move to solar in Georgia by the end of this year. The Mooresville plant should be done sometime in 2023, Grice said.

CKF acquires Canadian Thermoformed rPET Firm

HortiDaily

November 4 – Scotia Investments Limited (SIL), together with CKF, Inc. (CKF), have reached an agreement to acquire Packright Manufacturing Ltd. (Packright). Packright will become a wholly-owned subsidiary of CKF. Given the recognized legacy of innovation, quality, and customer service that has been built around the Packright brand, the company will continue to operate in the market as “Packright.” Its management team and staff are integral to the next stage of growth for the company as part of CKF. Colin Chiu will be appointed director – new market development, plastics.

CKF and Packright joining forces for the thermoformed rPET industry is a powerful combination.

Packright has a proven track record of building and growing markets, designing new products, and operating a lean manufacturing plant. For its part, CKF, established in 1933, operates five plants across Canada and two in the US in three material substrates: foam, rPET, and molded pulp. CKF services many of the same customers as Packright and operates in similar markets in North America, so the acquisition offers both companies and the combined customer base benefits of scale, design, and market access. Packright will gain access to CKF’s capital strength, manufacturing expertise, and capacity, while CKF will benefit from Packright’s design prowess, its market reputation for quality products, and its established, loyal customer base.

Most importantly, the combined customer base will have access to a deeper and wider product line, expanded production capacity from CKF’s Delta plant, and a vertically integrated supplier when CKF’s extrusion facility in Rexdale, Ontario, is operational in December 2022.
Examples of products Packright has developed and commercialized in the past.

“Counting Packright as part of the CKF family is a milestone for our entire group,” says Ian Anderson, president of CKF. “Not only are we gaining a tremendous depth of knowledge in rPET design and manufacturing, but the acquisition aligns with our vision and investment strategy to build the scale and standardization required for a sustainable, circular economy for rPET.”

“CKF is a natural partner for Packright,” says Chiu. “The similarity in vision and culture of our two companies and CKF’s willingness to invest in growth made them an easy choice as a partner.”

“On behalf of our Board and shareholding family, I extend a warm welcome to the employees of Packright,” says SIL president and chief executive officer Randy MacMillan. “We look forward to working together to build a sustainable future, incorporating leading-edge closed-loop strategies for rPET. Packright is yet another example of how SIL is investing in growth opportunities and organizations whose employees and customers value leading-edge sustainable products, long-term stewardship, environmental integrity, and community well-being.”

CKF recently completed its acquisition of MFT-CKF, Inc., which designs, manufactures, and distributes environmentally responsible molded pulp protective packaging solutions for consumer goods, electronics, and industrial products from plants in Clinton, Iowa, and El Paso, Texas.

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 ...

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Essentials of Management & Leadership in Plastics is a six-month virtual program starting in February 2023 and running through July 2023. The program is open to early to mid-level career professionals (with varying titles and roles within specific organizations) who are looking to become leaders or strengthen their leadership skills at their companies and in the plastics industry. No other Leadership Certificate program exists that is specifically designed for those in the plastics industry.

To apply for Essentials of Management & Leadership in Plastics, go to www.4spe.org/LeadershipEssentials.
I wish we had an ILLIG...

WOW. We’re getting perfect products in 20 minutes. I’ve never seen that on other machines.
The U.S. plastics industry is a major player in world trade. This edition of the Plastics Industry Association’s annual Global Trends study analyzes U.S. trade data on an industry-wide and segment-specific basis for 2021. It also provides a peek at 2022 and beyond.

The report is divided into six sections. Section I describes exports, imports, and the trade balance for the industry and its five segments: resins, plastic products, molds, machinery and “other plastics.” Section I also measures trade flows as a percentage of domestic shipments.

Section II analyzes apparent consumption and market shares for the industry and its segments. Section III discusses trade in goods that contain resins and plastic products, labeled “contained trade” in this study. Section III also measures the “true” consumption of resins and plastic products, which includes plastics that are contained, or associated with, other products and services that are consumed. Section IV presents forecasts of world trade, U.S. general trade, U.S. plastics trade, and the shipments and apparent consumption of plastics in the U.S. through the year 2029. Section V highlights U.S. plastics trade in the first half of 2022. Finally, Section VI provides a world perspective on plastics production, consumption and trade, including snapshots of five important U.S. trading partners.

The study’s key findings are:

**INDUSTRY-WIDE TRENDS**

1. The U.S. plastics industry’s trade deficit grew to $10.1 billion in 2021 from $5.4 billion in 2020.

2. Industry exports rose 23.3%, and imports rose 28.9%. Inflation was a big factor in those rises.

3. Mexico and Canada remained the U.S. plastics industry's largest export markets. In 2021, the industry exported $18.0 billion to Mexico and $15.0 billion to Canada.

4. The industry had its largest trade surplus with Mexico in 2021—$10.8 billion.

5. China is the industry’s third largest export market. However, the industry, overall, had its largest trade deficit with China—$18.2 billion in 2021.

6. The estimated value of domestic shipments rose 21.3% in 2021, to $338.7 billion. Shipments figures were inflated by higher raw material costs.

7. Exports amounted to 21.1% of domestic shipments in 2021, up from 20.7% in 2020.

8. Apparent consumption of plastics industry goods rose 22.6%, from $284.6 billion in 2020 to $348.9 billion in 2021. This included a lot of inflation.

9. “True” consumption includes all the resins and plastic products that U.S. residents consume, including those that are contained in imported goods. The “true” consumption growth rates computed in this study show that underlying U.S. plastics demand remains solid. They also show that the U.S. market for plastics is larger and growing faster than the market being addressed by domestic producers.

**RESIN TRENDS**

1. The U.S. resin industry had a $19.6 billion surplus in 2021, which was up 5.1% from the $18.6 billion surplus in 2020.

2. Thanks to growing new supplies of low-cost feedstocks, made possible by unconventional, shale-related drilling techniques, U.S. resin producers continued to enjoy a cost advantage over most foreign producers.

3. U.S. resin exports increased 27.6% in dollar terms from 2020 to 2021, while imports increased 58.2%. Higher resin prices were a key driver.

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1 The methodologies and data used to estimate the value of domestic shipments and contained trade values were provided by Probe Economics LLC.
4. The resin industry had an $8.1 billion surplus with Mexico, followed by a $2.6 billion surplus with China.

5. The resin industry had its largest trade deficit with Germany, at $1.4 billion.

6. Resin exports accounted for 39.9% of domestic shipments, while imports were 21.0%.

7. Apparent consumption of resins rose 45.3%, from $57.6 billion in 2020 to $83.7 billion in 2021. Resin prices realized by U.S. producers rose 33.4%, as measured by the Producer Price Index, which suggests that apparent consumption increased 11.9% in real, tonnage terms.

8. U.S. resin producers held a 74.1% market share (percent of apparent consumption) in 2021, down from 76.2% in 2020.

9. The estimated value of resins contained in exported goods was $22.9 billion, and the estimated value of resins contained in imported goods was $64.4 billion, which meant that the segment had a $41.5 billion deficit in contained resin trade.

PLASTICS PRODUCTS TRENDS

1. The country's deficit in plastic products increased from $20.8 billion in 2020 to $26.0 billion in 2021, an increase of 25.1%.

2. Exports of plastic products rose 18.3%, while imports rose 21.4%.

3. The U.S. had its largest plastic products surplus with Mexico—at $2.2 billion.

4. China accounted for the largest plastic products trade deficit, at $20.3 billion, up 14.2% from 2020. Countries like Taiwan, South Korea and Vietnam are starting to bite into China’s market share.

5. Exports of plastic products were 12.4% of domestic shipments, and imports were 23.8%.

6. Apparent consumption of plastic products grew 16.9%, from $217.2 billion in 2020 to $253.9 billion in 2021. As measured by the Producer Price Index, plastic products prices realized by U.S. producers rose 13.6% in 2021, suggesting that apparent consumption growth was 3.3% in real terms.

7. U.S. producers of plastic products held a 78.6% market share (percent of apparent consumption), down from 79.4% in 2020.

8. The estimated value of plastic products contained in exports was $26.0 billion in 2021, and the estimated value contained in imports was $63.7 billion, giving the U.S. a $37.7 billion deficit in contained plastic products trade.

MOLDS TRENDS

1. The U.S. moldmaking industry had a $1.5 billion trade deficit in 2021, which was 21.8% more than the deficit in 2020.

2. Mold exports fell 2.7%, while imports rose 14.3%.

3. The U.S. moldmaking industry had its largest surplus with Mexico, at $297 million. It had its largest deficit with Canada, at $834 million.

4. Exports of molds were 16.7% of domestic shipments, and imports were 63.8%.

5. Apparent consumption of molds for plastics rose 18.3%, from $4.0 billion in 2020 to $4.7 billion in 2021.

6. U.S. moldmakers held a 55.5% market share (percent of apparent consumption) in 2021, up from 52.4% in 2020.

MACHINERY TRENDS

1. The U.S. plastics machinery industry registered a $2.2 billion trade deficit in 2021, an increase from $2.0 billion in 2020.

2. Exports rose 19.7%, and imports rose 15.5%.

3. The industry had its largest surplus with Mexico at $213 million, and its largest deficit with Germany at $708 million.

4. Exports of machinery were 28.6% of domestic shipments, and imports were 79.6%.

5. Apparent consumption of plastics machinery rose 14.4%, from $5.8 billion in 2020 to $6.6 billion in 2021. Domestic shipments rose 15.0%.
6. U.S. machinery producers held a 47.3% market share (percent of apparent consumption) in 2021, down from 47.8% in 2020.

FORECASTS

1. The world economy has mostly recovered from the deep coronavirus-related recession. All aspects of the plastics industry were affected.

2. World trade volumes grew rapidly from 2001 to 2008, dipped and recovered from the 2008-09 recession, and, in real terms, have oscillated around a flat trend since then. Trade dropped off during the COVID-19 recession and then bounced back. Trade is unlikely to resume the trend of increased globalization that existed up to 2011.

3. U.S. manufacturers have steadily lost share in their own domestic market to imports. That trend appears to be continuing into 2022. Restoration of the domestic share would take a concerted effort by the government to bring manufacturing back to the U.S. – lots of money and incentives. Deadlock appears likely to be the mode of government until after the 2024 elections, so at least another couple of years of share loss seems likely.

4. The U.S. plastics industry trade balance went from positive to negative in 2020, and it became even more negative in 2021. Data through the first half of 2022 suggest further deepening of the deficit, and the authors project a continued deepening through 2023. After that, some improvement is likely, but not certain.

5. U.S. plastics industry apparent consumption correlates well with gross domestic product (GDP), down during recessions and up during recoveries. Because of the economic recovery that is now underway, and because of inflation, the authors expect a significant increase in apparent consumption. Specifically, they expect U.S. plastics industry apparent consumption, nominally, to grow 33.0% between 2021 and 2029, for an annualized increase of 3.6% per year.

U.S. PLASTICS TRADE IN FIRST SIX MONTHS OF 2022

1. U.S. plastics industry trade volume (exports plus imports) increased 17.0% in the first six months of 2022, compared to the same period in 2021. Inflation played a role in this.

2. Plastics industry exports rose 16.9% in the first six months, and imports rose 17.0%. As a result, the industry’s trade balance went from a $4.4 billion deficit in the first six months of 2021 to a $5.2 billion deficit in the first six months of 2022.

3. Resin exports increased 20.9% in the first six months of 2022 compared to a year earlier. Imports increased 33.4%, from a smaller base, resulting in a 9.5% increase in the country’s resin trade surplus.

4. The country’s plastics products trade deficit continued to grow in the first six months of 2022, up 12.5% from the comparable 2021 period. Exports were up 12.3%, and imports were up 12.4%.

5. Exports of molds for plastics were up 1.6% in the first half of 2022. Imports were up 5.3%. The molds trade deficit grew 6.6%.

6. Plastics machinery exports were up 0.5% in the first six months of 2022. Imports were up 5.5%. The country’s trade deficit in plastics machinery grew 8.2%.

INTERNATIONAL PLASTICS INDUSTRY

1. The large and growing plastics industry outside the U.S. will continue to compete with the U.S. for overseas markets as well as for its own domestic markets.

2. The U.S. was the world’s top plastics and rubber producer up until 2005. In 2021, Chinese plastics and rubber production was 2.8 times that of the U.S.

3. Plastic and rubber consumption in a country is determined by its population, level of development and focus on manufacturing. Mature, industrialized countries like France, Germany and the U.S. have apparent consumption of plastic and rubber between $700 and $1,100 per capita.

4. India, a developing country, consumed only $53 of plastic and rubber per capita in 2021.

5. China, which consumed only $86 of plastic and rubber per capita in 2005, shot up to $566 per capita in 2021. That wasn’t all domestic consumption. A lot of it went into the manufacture of goods that were exported.

6. The biggest exporter of resin in 2020 was the U.S., followed by Germany, South Korea, China, and Saudi Arabia.

7. China was by far the biggest exporter of plastic products in 2020, followed by Germany, and the U.S.

8. China’s growth is slowing, but its dominance as a manufacturer, and therefore, as a consumer of plastic and rubber, is nearly unshakeable.
9. India is one of the great markets of the future, but it does not appear destined to duplicate China’s success with manufacturing, nor its consumption of plastic and rubber. Its success is more likely to come in services, which do not involve a lot of plastics.

10. South Korea is much smaller than China, but it has had similar successes in manufacturing and economic development, with similar emphasis on plastic and rubber. South Korea was highly successful at battling COVID-19, managing to experience only a 1% drop in GDP during 2020.

11. For the fifth year, PLASTICS releases an annual Global Plastics Ranking™. The ranking is based on trade volume estimates—the sum of exports and imports of four general classification of plastics, which altogether is referred to as the plastics industry: plastics machinery, molds for plastics, materials and resins, and plastics products. China, the U.S. and Germany remained the top three players in the global plastics trade in 2021.

Have an idea for an article?

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Lotok to past articles for guidance

Format: .doc or .docx

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This Is Plastics: Factual Resources for the Public

The Plastics Industry Association’s This Is Plastics website counters misconceptions with fact-based information.

The conversation around plastics can be one-sided. People don’t have to look far to find negative and sometimes poorly-written reports about plastics and the plastics industry. To change that conversation and offer the public truthful and factual information about plastics, the Plastics Industry Association (PLASTICS) created a website called ThisIsPlastics.com.

INFORMATION-RICH CONTENT FOR EVERYONE

Filled with articles, infographics and other resources, all created for a general audience, This Is Plastics is an incredible resource for anyone who wants to truly understand what plastics are and what they contribute to contemporary life—from the basics of “Plastics 101,” to everything plastics make possible in healthcare, food preservation, transportation safety and more. This is Plastics also offers a great location for industry people to retrieve information to share with others.

Terry Connell, Senior EHS Manager at Teknor Apex, stated the case for This Is Plastics in the Fall 2021 issue of PLASTICS magazine, calling it “plainspoken content that tells the real story of plastics.” She went on to write, “Those of us in the industry simply must drive the conversation about plastics. We need to talk with our friends, family and anyone who will listen about how important plastics are in our everyday lives. We need to share facts, in simple terms, using real world examples.”

FACTS, NOT RHETORIC

This Is Plastics also counters the false narrative of plastic as a danger to the environment. The fact is, plastics are often the most environmentally friendly option manufacturers have in creating their products, with an overall environmental footprint much smaller than that of alternative materials.

TRUTHFULNESS AND TRANSPARENCY

In putting the realities of plastics before the public, This Is Plastics doesn’t shy away from areas that need improvement. In keeping with the PLASTICS motto, “We love plastic. We hate plastic waste,” This Is Plastics dedicates plenty of space to discussing the need for improved recycling infrastructure and informing people on the latest recycling investments, technology and innovations coming out of the industry.

STAY UP-TO-DATE AND SPREAD THE WORD

This Is Plastics is always adding new content, so PLASTICS recommends that people visit the site often and follow @ThisIsPlastics on Twitter to be notified about new posts and retweet the truth about plastics.
ANTEC® 2023 will showcase the latest advances in industrial, national laboratory, and academic work. Learn about new findings and innovations in polymer research, products, and technologies. There will be multiple opportunities to spend time with colleagues at SPE-hosted meetings, receptions, networking luncheons, and SPE Chapter networking events.

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Polymers From Renewable Raw Materials as a Drop-In Solution With Co₂ Advantage

The plastics industry is turning to new raw materials to reduce greenhouse gas emissions and thus counteract climate change. A joint feasibility study by four companies along the plastics value chain shows that a switch to renewable materials is possible without compromising quality.

Climate change requires a rethink by everyone, including the plastics industry. To date, the predominant raw materials used in the production of polymers are fossil-based: the crude oil demand of the global petrochemical industry is between 10 and 15 million barrels per day¹.

Greenhouse gas emissions are associated with the production of the crude oil used as a raw material, and additional greenhouse gas emissions can occur at the end of the life of the plastic products when they are incinerated for energy recovery, for example. In view of the ambitious climate targets, several companies are working on ways to replace fossil raw materials. In addition to recycling, great hopes are pinned on renewable raw materials.

In a joint project this spring, the four companies ILLIG, LyondellBasell, Fernholz and Neste demonstrated that the use of such renewable raw materials is not only possible with existing infrastructure, but also without compromising the quality of the end products². The subject of the project was the production of a conventional yogurt cup from the plastic polypropylene (PP) with a measurable renewable content.

The project focused on four process steps along the value chain, with each of the participating companies having a specific role: (1) The provision of a renewable base raw material by Neste for the production of renewable PP. (2) The production of the renewable PP granules by LyondellBasell. (3) The processing of the granules into films by Fernholz, and (4) the subsequent thermoforming by ILLIG. At the same time, steps (2) to (4) were also carried out with a conventional PP alternative based on fossil raw materials for direct comparison.

² Versuchsbericht: Materialvergleich von konventionellem und aus nachwachsenden Rohstoffen hergestelltem PP, March 2022; ILLIG, Neste, LyondellBasell, Fernholz.
Chemically, these renewable raw materials are indistinguishable from fossil ones. This allows them to be used identically, for example as a raw material for the plastics and chemical industries. They can be used in pure form or mixed with fossil hydrocarbons. However, there is a big difference when looking at the carbon footprint. Using renewable raw materials means drawing on carbon from the natural carbon cycle: for example, plants used to produce the oils and fats absorbed carbon from the atmosphere as they grew. This is reflected in the carbon footprint: the use of 100% renewable Neste RE, for example, reduces greenhouse gas emissions by over 85% compared to fossil raw materials.\(^3\)

**LYONDELLBASELL: Polypropylene with Smaller Carbon Footprint**

The renewable hydrocarbons were used in a next step by LyondellBasell to produce polypropylene. LyondellBasell’s goal is to produce two million tons of recycled and renewable polymers annually by 2030. Since 2021, the company has been producing polypropylene and polyethylene from renewable feedstocks on a commercial scale via both mass balancing and measurable C14 (Certified Carbon 14) content as part of its Circulen portfolio. The goal of the Circulen portfolio is to achieve sustainable solutions, so Neste RE is a great fit as a feedstock for the product line. CirculenRenew with measured and certified C14 content was chosen for this study.

At LyondellBasell’s steam cracker plant in Wesseling, Germany, the long-chain renewable hydrocarbons were processed into shorter monomers. They were then polymerized into PP pellets. In several trials, LyondellBasell was able to demonstrate that the processing of the raw material based on renewable raw materials is identical to that of fossil raw materials. Accordingly, the hydrocarbons could also be processed in the cracker and the existing plant infrastructure and then polymerized in exactly the same way as fossil raw materials.

**FERNHOLZ: Sheet extrusion without compromise in quality**

The PP resins were processed at next step into PP sheet at the Fernholz plant. The extrusion equipment was the latest “high-speed” extruder type and state-of-the-art roll-stack technology, which were operated with identical parameters such as temperatures, output, etc. for fossil and bio-based CirculenRenew resin with a focus to use standard process conditions to ensure comparability with regular production. In the extruder part, the resins were processed into plastic melt at over 200 degrees Celsius and converted into sheet with a dimension of 1.2 x 730 mm. During extrusion, relevant process parameters were monitored and the regular QA procedures were carried out.

No differences were found between sheet based on fossil PP resources and sheet based on bio-based CirculenRenew PP granules. CirculenRenew-PP granules can thus be processed into PP sheet in exactly the same way as the fossil variant.

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\(^3\) Life Cycle Assessment on Environmental Impacts of Neste Renewable Polymers and Chemicals (30 June 2021).
ILLIG: No measurable differences during thermoforming

During thermoforming at the ILLIG Technology Center in Heilbronn, Germany, an RDM 73K production machine and a 30-cavity cup production mold were subsequently used for sample production (SR 45764) to produce a 200ml yogurt cup. The cycle rate was 29 cycles per minute. A polypropylene film made from fossil raw materials with the same dimensions was used as a comparison to the renewable CirculenRenew film. The focus was to look at thermoformability, shrinkage, stack height, top load, and wall thickness distribution of the cup patterns. The mold shrinkage was measured with an optical test rig, the stack height was measured mechanically after internal testing. ILLIG carried out the Top Load with a 2.5kN material testing machine according to DIN 55440. The wall thickness distribution was determined with a ball gauge at several positions.

As a result, both films, based on renewable and fossil raw materials, could be thermoformed with identical machine parameters. The obtained cup characteristics were extremely similar, so that no significant deviations were measurable. With regard to thermoforming, the two PP grades investigated can therefore be regarded as identical.

CONCLUSION: Renewable raw materials are suitable as a drop-in solution

The project of the four companies involved shows that renewable raw materials are suitable as a so-called “drop-in” solution: They can be used and further processed along the entire value chain in existing plants. Differences in quality or product properties do not occur. They thus offer an opportunity to reduce greenhouse gas emissions with very low implementation hurdles. Due to their identical chemical composition, products made from both renewable and fossil PP can also be recycled at the end of their life, making them suitable for a circular economy in the plastics industry.

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Improved Polypropylene Thermoformability Through Polyethylene Layering

Laryssa Meyer, Alex M. Jordan, University of Wisconsin – Stout, Menomonie, WI; Kyungtae Kim, Bongjoon Lee, Frank S. Bates, Christopher W. Macosko, University of Minnesota, Minneapolis, MN; Ehsan Behzedfar, Ryerson University, Toronto, Ontario; Olivier Lhost, Total S. A., Feluy, Belgium

Abstract

While the flow forces governing primary melt-based polymer processing techniques, such as extrusion and injection molding, have been extensively studied, characterization of forces in secondary processes such as thermoforming is limited. In this work we utilize multilayer coextrusion to create an extruded film with 100s of alternating linear low density polyethylene (LLDPE) and isotactic polypropylene (iPP) layers; and by extension, 100s of interfaces. The combination of LLDPE, iPP, and these interfaces decreases the elastic storage modulus (E') and broadens the rubbery plateau observed via dynamic mechanical analysis (DMA). The broadening of the rubbery plateau is correlated with an observed improvement in LLDPE/iPP multilayer thermoformability compared to the homopolymer LLDPE and iPP films.

Introduction

Due to its low cost and rigid mechanical properties, isotactic polypropylene (iPP) makes an excellent candidate for packaging applications. However, it is notoriously difficult to thermoform due to its low melt strength. Some applications use high molecular weight (low melt index) iPP for thermoforming. [1] Macauley et al. have shown that incorporating nucleating agents improves the thermoformability and extensional processing of iPP. [2] A number of other researchers have utilized reactive extrusion to create long chain branched iPP to improve thermoformability. [3,4] Specifically, Münstedt and colleagues correlated the improved thermoformability to strain hardening behavior observed during transient extensional viscosity measurements.

In our previous work we have been able to achieve strain hardening behavior in iPP melts by exploiting the interfacial tension that exists in multilayer polymer films. [5,6] Additionally, we have probed the adhesion between various iPP and polyethylene grades; finding excellent adhesion and mechanical properties when a metallocene catalyzed iPP is combined with a metallocene catalyzed linear low density polyethylene (LLDPE). [7-10] Here we build on our previous work with polyolefin interfaces and multilayer coextrusion to exploit the immiscible metallocene LLDPE/iPP interface to create multilayers of LLDPE/iPP for thermoforming with excellent interlayer adhesion and mechanical properties. Coupled with previous improvements in barrier properties observed in multilayer films, [11,12] this work is could represent a significant improvement in thermoformed Experimental

Two polyolefins were used in this study either from Total or Exxon. Both LLDPE (Exxon Exceed 3518, MFI = 3.5 g/10 min, ρ = 0.918 g/cm3) and iPP (Total MR2001, MFI = 25 g/10 min, ρ = 0.905 g/cm3) were used as received.

Multilayer LLDPE/iPP (50/50 vol/vol) films were fabricated via coextrusion. The coextrusion technique is described in great detail elsewhere [11]. Briefly, one extruder was fed LLDPE while a second extruder was fed iPP. Each extruder fed to a metered gear pump before going to a 20 layer feedblock. The 20 layer system was passed through 5 layer multipliers that double the number of layers in the flow with each multiplication device so that the final number of layers was ~640.

Multilayer LLDPE/iPP films, as well as LLDPE and iPP controls were cut into rectangular strips (30 mm × 6 mm) to for DMA (TA Instruments Q800) characterization. Temperature sweeps were conducted at a rate of 20 Hz (strain = 0.1%) over the range 25 °C to 180 °C at a rate of 2 °C/min. A minimum of 3 specimens were tested for each sample for reproducibility. Strain direction was parallel to the extrusion direction of the films.

For thermoforming, multilayer samples were cut into 75 × 75 mm squares. The heater setting on the thermoforming apparatus (Formtech Inc.) was set to full power, and film temperature was monitored by an independent thermocouple. Samples were formed at a vacuum level of -30 mmHg over a custom form. The form had a 38 mm diameter base and 13 mm diameter top with a constant 60° taper.

Results & Discussion

Examining the elastic storage modulus (E') from each DMA temperature sweep revealed a very sharp transition from
CUSTOMIZATION CREATED THROUGH INNOVATION

THE JOURNEY BEGINS WITH KYDEX® THERMOPLASTICS
flexible solid to molten liquid in the high melt index iPP homopolymer, which is indicative of poor thermoformability (Figure 1). Although LLDPE is also semi-crystalline by nature, the transition from flexible solid to molten liquid occurs much more gradually. Coupling this behavior with the high melt index, it would seem that LLDPE homopolymer is a good candidate for thermoforming. However, do to its flexibility it is not necessarily a desirable candidate for thermoformed packaging. The LLDPE/iPP multilayer film exhibits a much more gradual transition from flexible solid to molten liquid with a much more gradual rubbery plateau than iPP homopolymer. This gradual transition suggests the LLDPE/iPP multilayer may be a good candidate for thermoforming.

By completing the initial thermoforming trials at two temperatures (112 °C and 121 °C) it is possible to screen for thermoformability. It is clearly seen that even though iPP has a high $E'$ at these temperatures, the films rupture during the forming process. (Figure 2) After rupturing, it is not possible to achieve a good vacuum draw and the parts are of unusable quality. The temperature of 112 °C is at the highest range of temperatures that appear in the “semi-melt” window for thermoforming LLDPE, while it is below the low end of the semi-melt window for the LLDPE/iPP multilayers. Minor defects that appear as local thinning are visible in the LLDPE control film. The LLDPE/iPP multilayer thermoforms qualitatively well, although the edge definition of the formed cone has some defects, likely due to the high $E'$ at 112 °C. When the temperature is increased to 121 °C, $E'$ for the LLDPE control is ~1 MPa, while it is ~100 MPa for the LLDPE/iPP multilayers and approaching the semi-melt temperature range. It is clearly seen in Figure 2 that the edge definition of the thermoformed multilayer has improved significantly, with further improvement possible at higher temperatures. The local thinning visually observed in LLDPE at 112 °C significantly worsened with the increase in temperature to 121 °C. higher temperatures. The local thinning visually observed in LLDPE at 112 °C significantly worsened with the increase in temperature to 121 °C.

Conclusions
Dynamic mechanical analysis was used to screen a LLDPE/iPP multilayer film for thermoformability. Based on the range of temperatures and $E'$ measured, two thermoforming temperatures were selected for initial trials. The iPP selected had very poor thermoformability due to its high melt index. Although the selected LLDPE formed into a cone, its inherent flexibility and large number of observable defects suggest it is also a poor packaging candidate. The LLDPE/iPP multilayer film exhibited a significant improvement in thermoformability. Coupled with the excellent adhesion previously observed between metallocene LLDPE and metallocene iPP and resulting improvement in blend mechanical properties, this architecture may be very promising for packaging applications.

Acknowledgements
This research was supported by a grant from Total S. A. with partial support by the Industrial Partnership for Research in Interfacial & Materials Engineering (IPRIME). Polymers were graciously provided by Total S. A. and ExxonMobil Corporation.
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- Ease of Access
- Reliability

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References

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2022 Comet 6’ x 10’ Single Station Thermoformer
1999 GN 3021C Thermoformer
CNC Router DMS 5 Axis Single 5’ x 10’ Table

“HIGHEST QUALITY EQUIPMENT AND SERVICES IN THE INDUSTRY”
Grade B Bale Composition Analysis

**Editor’s Note:** Originally written in 2020, this PET bale study was commissioned by the Plastic Recycling Corporation of California (PRCC). Given the current market environment for recycled PET - as well as the legislative efforts underway in CA (see related story on p.32) - we offer this article to our readers for deeper context on the realities / economics of PET thermoforming recycling.

**INTRODUCTION**

Plastic Recycling Corp. of California (PRCC) is committed to ensuring California PET bales meet or exceed PRCC quality standards. Our goal is to add value to quality loads, increase yield, and encourage Material Recovery Facilities (MRFs) to separate PET thermoforms from the PET bottles.

This study was undertaken to determine what—if any—clear differences there are between Grade B bales from auto-sort facilities and hand-sort facilities. The results of this study clearly reveal that there are two types of Grade B PET bales in California: those that include PET thermoforms along with PET bottles, and those which do not. Bales with thermoforms have a significantly lower percentage of clear/light-blue PET bottles averaging 62% (versus 84% in bales that do not include thermoforms), and average twice as much contamination. Even more importantly, in bales with thermoforms, CRV PET comprised only 44% of the bale compared to 77% CRV PET in bales without thermoforms.

PRCC has added a new bale specification: (italics added for emphasis) Grade B with Thermoforms. More accurate bale pricing—in combination with modernizing the CA Beverage Container Recycling program—will encourage MRFs to keep thermoforms separate from PET bottles. This will improve quality and increase recovery for both PET bottles and PET thermoforms.

**PROCEDURE**

PRCC staff sorted over 3,600 pounds of Grade B PET from eighteen MRFs throughout CA. Eleven of the samples (total 2,279 lbs) were from facilities with auto-sort technology, and six samples (total 1,206 lbs) were from facilities that use positive hand sort, the last sample (200 lbs) was from a facility that instructs its employees to pull thermoforms along with the PET bottles.

PRCC used the Association of Plastic Recyclers’ Protocol for Assessing PET Truckload Bale Grade. PRCC has tested this methodology and determined that it accurately reflects the composition of bales.

For each bale, PRCC staff noted the grade and type of sortation (auto or positive sort), recorded the source location, daily throughput, and collection public messaging (did the collection program—specifically or by default—ask for PET thermoforms).

Next, PRCC staff pulled sample of at least 200 pounds from random locations within the bale to get a representative sample. The sample material was then sorted by category, weighed, and the results were recorded.

![Grade B Bale Composition Analysis Table]

<table>
<thead>
<tr>
<th>FIRST SORT</th>
<th>SECOND SORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRV PET [Weigh and Count Samples]</td>
<td>Clear &amp; Light Blue</td>
</tr>
<tr>
<td></td>
<td>Green</td>
</tr>
<tr>
<td></td>
<td>Other Colors</td>
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<td>Full Wrap</td>
</tr>
<tr>
<td></td>
<td>Barrier</td>
</tr>
<tr>
<td></td>
<td>With Metal</td>
</tr>
<tr>
<td>Non-CRV PET Bottles [Weigh and Count Samples]</td>
<td>Clear &amp; Light Blue</td>
</tr>
<tr>
<td></td>
<td>Green</td>
</tr>
<tr>
<td></td>
<td>Other Colors</td>
</tr>
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<td>Full Wrap</td>
</tr>
<tr>
<td></td>
<td>Barrier</td>
</tr>
<tr>
<td></td>
<td>With Metal</td>
</tr>
<tr>
<td>PET-like Thermoform</td>
<td>Clear PET</td>
</tr>
<tr>
<td></td>
<td>Colored PET</td>
</tr>
<tr>
<td></td>
<td>Non-PET</td>
</tr>
<tr>
<td>Non-PET Plastics</td>
<td></td>
</tr>
<tr>
<td>Aluminum/ Metal</td>
<td></td>
</tr>
<tr>
<td>Other Contaminants/Trash</td>
<td></td>
</tr>
</tbody>
</table>
FINDINGS

The results of the bale sort inarguably reveal that MRFs with auto-sort technology have a significant amount of PET thermoforms in the bales: unless they pull the thermoforms to create a separate thermoform bale. MRFs that positive sort PET bottles by hand, have very few PET thermoforms: unless they instruct their employees to put thermoforms in with the PET.

In bales with thermoforms, CRV PET comprised only 44% of the bale compared to 77% CRV PET in bales without thermoforms.

We saw no pattern in the location, size of the MRF, level of residue nor what they accepted. Ironically, facilities that do not accept PET thermoforms had the highest percentage of thermoforms in both auto-sort MRFs (32% thermoforms) and positive-sort MRFs (0.8% thermoforms).

<table>
<thead>
<tr>
<th>Total Auto Sort</th>
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<th>Percent</th>
<th>Spread</th>
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<td></td>
</tr>
<tr>
<td>CRV PET</td>
<td>1017</td>
<td>44.6%</td>
<td>36% - 58%</td>
</tr>
<tr>
<td>Non-CRV PET</td>
<td>662</td>
<td>29.1%</td>
<td>21% - 38%</td>
</tr>
<tr>
<td>PET Thermo</td>
<td>428</td>
<td>18.8%</td>
<td>11% - 32%</td>
</tr>
<tr>
<td>Other plastic</td>
<td>36</td>
<td>1.6%</td>
<td>0% - 3%</td>
</tr>
<tr>
<td>Trash</td>
<td>104</td>
<td>4.6%</td>
<td>1% - 13%</td>
</tr>
<tr>
<td>Metal</td>
<td>32</td>
<td>1.4%</td>
<td>0% - 3%</td>
</tr>
</tbody>
</table>

AUTO-SORT MRFS

Auto-Sort MRFs averaged 19% PET thermoforms. There was also twice as much trash as compared to the hand sort MRFs (4.6% vs 2.3%). PET bottles averaged 74% of the bale, and clear/light blue PET bottles averaged only 63% of the bale. Other averages were: green bottles—3.5%, other color—1.5%, full-wrap labels—4.5%, barrier bottles—0.6%, and bottles with metal components—0.8%.

POSITIVE-SORT MRFS

Positive-Sort MRFs averaged less than one percent PET thermoforms. The bales were generally very low in trash and other contaminants; PET bottles comprised an average of 97% of the bale and clear/light blue PET bottles averaged 84% of the bale. Other averages were: green bottles—6.7%, other color—0.4%, full-wrap labels—5.3%, barrier bottles—0.3%, and bottles with metal components—0.5%.

POSITIVE-SORT MRF INCLUDING THERMOFORMS

The positive-sort facility pulling thermoforms had just under 25% thermoforms. The bales had a significant amount of trash (7.5%) and other plastic (4%) most of which was PET thermoform lookalikes. The bales had only 64% PET bottles and only 54% of them were Clear/ Light-blue.

CONCLUSIONS

The results of this study clearly reveal that there are two types of Grade B PET bales in California: one from those that include PET thermoforms in with PET bottles, and one from those that remove them from the stream to create a separate thermoform grade bale.
PRCC staff determined a new Grade B bale is appropriate. Staff discussed these findings with APR and NAPCOR, both organizations approved the concept of two Grade B bale specifications. We also discussed the new specification with all of the California B-Grade reclaimers and all of the PRCC’s domestic buyers of California Grade B. All parties agree that there is a need for a Grade B bale specification with thermoforms and one without.

PRCC now has four PET bale specifications, all of which can be found on the website: PRCC.biz:
- Grade A
- Grade B
- Grade B with Thermoform
- Thermoform

It is too soon to determine if there will be an increase in value for standard Grade B bales, although it is likely. It is also likely that the Grade B with Thermoform bales will have a significantly lower value than standard Grade B. PRCC will make public pricing spreads once a clear pattern in value has emerged.

PRCC strongly encourages MRFs to separate PET thermoforms from the PET bottles. There are several buyers consistently taking PET thermoform loads. Keeping thermoforms separate from PET bottles improves the economics of PET bottle reclamation through improved yields and results in better quality rPET being cycled back into new PET bottles.

Not surprisingly, bottle bales with thermoforms have a significantly lower percentage of clear/light-blue PET bottles averaging 62% [with a range from 49% to 76% clear/light-blue PET bottles] compared to PET bottle bales without thermoforms which average 84% clear/light-blue [with a range from 76% to 90% clear/light- blue PET bottles].

Unfortunately, the current Beverage Container Recycling program is inhibiting this change. The commingled rate allows PET thermoforms to be counted as non-CRV PET. This unfairly enriches programs that combine PET bottles with thermoforms, and creates a disadvantage to programs that separate them.

PRCC believes that with more accurate bale pricing and modernization of the CA Beverage Deposit program, most MRFs will keep thermoforms separate from PET bottles resulting in improved recycling rates and higher recovery for both materials.
The positive-sort facility pulling thermoforms had just under 25% thermoforms. The bales had a significant amount of trash (7.5%) and other plastic (4%) most of which was PET thermoform look-alikes. The bales had only 64% PET bottles and only 54% of them were Clear/Light-blue.

**Included in Other Plastic**

<table>
<thead>
<tr>
<th></th>
<th>Total Positive Sort With Thermoforms</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pounds</td>
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<tr>
<td>Total Sorted</td>
<td>199</td>
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<tr>
<td>CRV PET</td>
<td>78</td>
<td>39.1%</td>
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<tr>
<td>Non-CRV PET</td>
<td>50</td>
<td>24.9%</td>
</tr>
<tr>
<td>PET Thermo</td>
<td>49</td>
<td>24.4%</td>
</tr>
<tr>
<td>Other plastic</td>
<td>8</td>
<td>4.0%</td>
</tr>
<tr>
<td>Trash</td>
<td>15</td>
<td>7.5%</td>
</tr>
<tr>
<td>Metal</td>
<td>0.10</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

|                                | Total Positive Sort With Thermoforms |  |
|                                | CRV Bottles | Non-CRV Bottles |  |
|                                | Pounds | Percent | Pounds | Percent |  |
| Clear/Lt Blue                  | 71     | 35.8%   | 37     | 18.6%   |  |
| Green                          | 5      | 2.3%    | 0.5    | 0.3%    |  |
| Other Color                    | 0      | 0.0%    | 1      | 0.5%    |  |
| Full Wrap                      | 2      | 1.0%    | 9      | 4.3%    |  |
| Barrier                        | 0      | 0.0%    | 1      | 0.5%    |  |
| Metal                          | 0      | 0.0%    | 2      | 0.8%    |  |

|                                | PET-like TF |  |
|                                | Pounds | Percent |  |
| Clear                          | 48.4   | 24%     |  |
| Colored                        | 0.2    | 0.1%    |  |
| Non-PET**                      | 7.5    | 3.8%    |  |

**Included in Other Plastic**
### APPENDIX A: AUTO-SORT DATA

<table>
<thead>
<tr>
<th>Sample # Location</th>
<th>1 South</th>
<th>2 South</th>
<th>3 South</th>
<th>4 North</th>
<th>5 North</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pounds</td>
<td>Percent</td>
<td>Pounds</td>
<td>Percent</td>
<td>Pounds</td>
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<tr>
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<td>98.70</td>
<td>48%</td>
<td>94.40</td>
</tr>
<tr>
<td>Non-CRV PET</td>
<td>68.15</td>
<td>34%</td>
<td>57.50</td>
<td>28%</td>
<td>63.40</td>
</tr>
<tr>
<td>PET Thermo</td>
<td>28.30</td>
<td>14%</td>
<td>23.00</td>
<td>11%</td>
<td>42.40</td>
</tr>
<tr>
<td>Other plastic</td>
<td>1.75</td>
<td>0%</td>
<td>3.00</td>
<td>1%</td>
<td>0.80</td>
</tr>
<tr>
<td>Trash</td>
<td>2.25</td>
<td>1%</td>
<td>17.40</td>
<td>8%</td>
<td>3.00</td>
</tr>
<tr>
<td>Metal</td>
<td>0.20</td>
<td>0%</td>
<td>6.50</td>
<td>3%</td>
<td>0.25</td>
</tr>
</tbody>
</table>

* Some communities utilizing this MRF accept thermoforms and some do not.

### Grade B Bale Composition Analysis

<table>
<thead>
<tr>
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<td>Metal</td>
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<td>6.50</td>
<td>3%</td>
<td>0.25</td>
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### Sample # Location

<table>
<thead>
<tr>
<th>Sample # Location</th>
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<th>7 North</th>
<th>8 North</th>
<th>9 South</th>
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<tr>
<td></td>
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<td>Percent</td>
<td>Pounds</td>
<td>Percent</td>
<td>Pounds</td>
<td>Percent</td>
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<td>205.20</td>
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<td>40.80</td>
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** Included in Other Plastic

### Sample # Location

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<td></td>
<td>205.20</td>
<td></td>
<td>200.55</td>
<td></td>
</tr>
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<td>CRV PET</td>
<td>81.00</td>
<td>38%</td>
<td>73.00</td>
<td>36%</td>
<td>91.85</td>
<td>46%</td>
</tr>
<tr>
<td>Non-CRV PET</td>
<td>74.80</td>
<td>35%</td>
<td>52.70</td>
<td>26%</td>
<td>40.50</td>
<td>21%</td>
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<tr>
<td>PET Thermo</td>
<td>41.00</td>
<td>19%</td>
<td>40.80</td>
<td>20%</td>
<td>63.70</td>
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<td>5.80</td>
<td>2%</td>
<td>1.00</td>
<td>0%</td>
</tr>
<tr>
<td>Trash</td>
<td>7.90</td>
<td>4%</td>
<td>26.40</td>
<td>13%</td>
<td>3.00</td>
<td>2%</td>
</tr>
<tr>
<td>Metal</td>
<td>3.50</td>
<td>2%</td>
<td>6.50</td>
<td>3%</td>
<td>0.50</td>
<td>0%</td>
</tr>
</tbody>
</table>

** Included in Other Plastic
### APPENDIX B: POSITIVE-SORT DATA

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<thead>
<tr>
<th>Key</th>
<th>12 North</th>
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<th>17 North</th>
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<th>20 South</th>
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<tr>
<td></td>
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<td>Percent</td>
<td>Pounds</td>
<td>Percent</td>
<td>Pounds</td>
<td>Percent</td>
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<td>98%</td>
<td>171.35</td>
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<td>1.60</td>
<td>1%</td>
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<td>0%</td>
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<td>0.25</td>
<td>0%</td>
<td>0.80</td>
<td>0%</td>
</tr>
<tr>
<td>Trash</td>
<td>2.5</td>
<td>1%</td>
<td>2.00</td>
<td>1%</td>
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<td>2%</td>
</tr>
<tr>
<td>Metal</td>
<td>0.5</td>
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<td>0%</td>
<td>0.50</td>
<td>0%</td>
</tr>
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<td></td>
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<td>0.10</td>
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</tr>
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</tr>
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<td>Non-PET**</td>
<td>0</td>
<td>0.0%</td>
<td>0</td>
<td>0.0%</td>
<td>0</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

** Included in Other Plastic

---

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Thermoform-to-Thermoform Bill Draws Mixed Reactions

Jared Paben
September 8, 2022
First published in Resource Recycling Magazine

Current debate over a California bill requiring PET thermoforms to contain RPET derived from thermoforms boils down to one question: What will materials recovery facilities do?

State lawmakers have sent to Gov. Gavin Newsom’s desk Assembly Bill 2784, which requires certain levels of post-consumer resin (PCR) in plastic thermoform food and drink packaging.

In the case of PET thermoforms, the packaging already often contains PCR, but that resin usually comes from recycled bottles. AB 2784 requires PCR from thermoforms themselves.

Because thermoforms aren’t included in state bottle deposit programs, brand owners will largely rely on materials recovery facilities (MRFs) to sort them from the curbside PET mix for sale to plastics reclaimers. But in California, not a lot currently do, in part because the California Redemption Value (CRV) system creates a de facto incentive for MRFs to keep thermoforms in PET bottle bales.

“This bill simply won’t work,” Steve Alexander, president of the Association of Plastic Recyclers (APR), said in an interview. “Unless there’s incentive for the MRFs to separate out thermoforms, then it’s very difficult for anybody to get their hands on the supply of material to make recycled content for thermoforms.”
(APR owns Resource Recycling, Inc., publisher of Plastics Recycling Update.)

However, another stakeholder is confident the bill will drive demand that will reverberate up the supply chain. Mark Murray, executive director of advocacy group Californians Against Waste, pointed to California’s existing RPET-content mandates for beverage bottles.

“We know we can affect the marketplace with the use of PCR. We know that that increased demand can translate into higher prices for the collection infrastructure,” he said.

“This [thermoform] policy was developed in real thoughtful recognition of the PET recycling marketplace and building on the success of PET bottle recycling,” he added.

**Mandates 10% PCR by 2025**

Newsom in September 2020 signed into law requirements that plastic beverage bottles covered by the CRV program contain certain levels of PCR.

The recently passed thermoform bill, AB 2784, is largely modeled off that bill. AB 2784 passed the state Senate in a vote of 22-11 (with seven legislators not voting) on Aug. 29, and it passed the Assembly 41-24 (with 15 not voting) on Aug. 30. Newsom has 30 days to sign or veto the bill.

The thermoform legislation covers a huge category of food and beverage packaging, including clamshells, cups, pods, tubs, lids, boxes, trays, egg cartons and other similar rigid, non-bottle packaging.

The bill requires thermoforms to average at least 10% PCR starting in 2025. Later requirements depend on overall recycling rates for thermoforms. The bill imposes a penalty of 20 cents for each pound of PCR the producer falls short of the target.

APR has long supported recycled-content mandates as a way to drive demand for recycled resins. But in this case, Alexander noted, a lack of supply is a major concern.

“Unfortunately, we’re in a position right now of trying to overturn this bill with a governor’s veto,” Alexander said.

He pointed out that under the CRV program, the California Department of Resources Recycling and Recovery (CalRecycle) establishes a formula estimating how many CRV-eligible containers are in each pound of a bale produced by MRFs, recognizing that a percentage of non-CRV material – thermoforms, mayonnaise jars and more – make it into bales.

Right now, using that formula, CalRecycle is paying MRFs a statewide standard “commingled” CRV rate of 62 cents a pound.

The Plastic Recycling Corporation of California (PRCC), a beverage industry-funded broker that buys PET bales from California MRFs and others, published a 2020 study that found curbside PET bales averaged about 19% thermoforms. PRCC created a specification for thermoform-only bales, but it pointed to the commingled payout as a big impediment to more MRFs producing more of those bales.

“Until you fix the commingled rate, as hard as you try, nothing else is going to really, ultimately provide the supply available to meet the intent of this legislation,” Alexander said. “The only way to do this is to get rid of the commingled.”

He noted that, regardless of the CRV program issues, many MRFs won’t sort, store and bale thermoforms because they’re a relatively low-volume commodity that doesn’t justify the sorting costs and bunker space.

**Recognition that some will fall short**

Murray of Californians Against Waste acknowledged many producers won’t be able to meet the requirements, just as many beverage companies are still using 0% PCR in bottles.

For instance, those producers using resins other than PET for thermoforms will run up against the fact there is a lack of FDA letters of no-objection for resin Nos. 2-7.

“We know that there are other thermoforms that can’t use PCR, but our objective here is to create an even playing field so that all plastic thermoforms have to meet a similar threshold, whether it was a financial threshold or a consumption-of-thermoforms threshold,” Murray said.

He doesn’t believe the penalty of 20 cents per pound will break any companies. “It’s certainly a cost and it’s certainly an enticement to comply with the requirement, but it’s not going to drive anyone out of business,” he said.
Murray acknowledged the commingled CRV rate issue and said “it is a true fact that those curbside recycling programs have an incentive to stuff as much PET ... in that bale as they possibly can.” The issue needs to be resolved, he said.

He noted that CalRecycle is now providing Quality Incentive Payments (QIPs) to recycling programs that produce PET bales with less than 2% PET thermoforms and other contaminants, an extremely high bar given the assortment of stuff that lands in curbside carts. But the amount, $180 a ton, is proving low to encourage widespread thermoform sorting.

Murray also said some facilities successfully keeping thermoforms out of PET bottle bales can work with CalRecycle staff to develop a higher CRV payment rate specific to their PET bales. By going that approach, they get paid more for bottle bales and they're still able to sell thermoform bales for scrap value.

Thirty-two curbside recycling facilities are currently enjoying the individualized commingled rates, CalRecycle data shows.

**Finer points of the bill**

The thermoform legislation is constructed with room for variation on the exact PCR percentages required.

If the statewide recycling rate for thermoforms is 50% or higher during the 2026 calendar year, then producers would need to average 20% starting in 2028. If the 2026 recycling rate is less than 50%, producers would have to average 25% PCR. Then, if the thermoform recycling rate in 2029 is 75% or more, thermoform producers would have to average 20% PCR. But if the recycling rate is below 75%, they would have to achieve 30% PCR.

The bill exempts certain categories of thermoforms, including those holding medicines or baby formula, as well as reusable and compostable packaging.

The legislation imposes an annual 20-cent penalty for every pound of PCR a producer falls short of their requirements. For example, if a brand owner sold 2 million pounds of PET thermoforms in 2025, the company would need to use 200,000 pounds of PCR. If it used 150,000 pounds of PCR, it would owe $10,000.

The bill allows CalRecycle to reduce the penalties, taking into account anomalous market conditions; lack of supply due to unforeseen events, such as a natural disaster; and other factors that have prevented the producer from meeting the requirements. If the thermoform recycling rate in California is 60% or higher, CalRecycle must also consider whether other industries, such as polyester textiles, are hogging the PET thermoform bales.

Producers failing to meet the minimum recycled content requirements would be required to submit corrective action plans to CalRecycle.

Penalty money would be deposited in a Thermoform Recycling Enhancement Penalty Account, which would be designated for spending that supports thermoform recycling in the state, according to the bill.

As is the case with PCR used in beverage bottles, producers would have to report their pounds of virgin and recycled resin used annually, and CalRecycle would post that data on its website.

It’s unclear how many brand owners currently use PCR from thermoforms in their packaging.

Watsonville, Calif.-based berry brand Driscoll’s explained to Plastics Recycling Update earlier this year how it has worked for years to encourage its suppliers to source RPET for Driscoll’s clamshells from recycled thermoforms. As of last year, Driscoll’s averaged 9% recycled-thermoform content in its clamshell containers.
$202,850 in scholarships awarded to 51 students at 31 universities.

$88,000 total grant dollars awarded. $34,367 raised from SPE membership renewal donations. $499,000 generously given to support the work of the SPE Foundation.

52 donors gave more than $25,500 for After-School SPE STEM Clubs on Giving Tuesday.

27 donors gave $10,275 for scholarships on June Giving Day.

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SPE Foundation and the Girl Scouts of Northeast Texas Announce Polymer Science Girl Scout Patch

Giving Tuesday Campaign Advances Support of SPE Girl Scout Patch Program

In collaboration with the Girl Scouts of Northeast Texas, the SPE Foundation has created its first SPE Color Your World with Polymer Science Girl Scout patch. Data shows that girls who are scouts are more likely than girls who are not scouts to become science, technology, engineering, math (STEM) professionals with leadership aspirations.

The newly released patch was introduced during Color Your World with Science, a science and engineering event, which took place at the Girl Scouts of Northeast Texas STEM Center of Excellence in Dallas, TX, on Saturday, September 24th. More than 200 Girl Scouts earned their patch and saw first-hand how polymer scientists and engineers are improving our world by developing new materials to make items like shoes, bike helmets, car parts, and more.

“Our goal with the Girl Scouts patch program is to inspire girls to become engineers and scientists and to help solve problems and create innovative materials and products to make the world a better place,” said Eve Vitale, Chief Executive, SPE Foundation. “The plastics industry will greatly benefit from women who understand the advantages we enjoy and the challenges we face – particularly when it comes to plastics.”

This upcoming Giving Tuesday (November 29), the SPE Foundation is inviting support for its Girl Scouts patch program to help bring this patch to more Girl Scouts and to create a second patch focused on Biopolymers and Sustainability. The first $10,000 in gifts will be matched by the SPE Automotive Division.

“Girl Scout councils across the country want our patch program but it costs thousands of dollars at the expense of the SPE Foundation,” said Vitale. “Through donations, our goal is to raise $25,000 to ensure more Girl Scouts can learn about the wonders of polymer science and engineering. Donations pave the way to help us share the exciting world of polymer science with young aspiring female STEM leaders. Let’s show the Girls Scouts that we support their future in STEM and that we’re focused on positive plastics education.”

Donations for the SPE Foundation Girls Scouts patch program can be made before Giving Tuesday by going to give.4spe.org
Dr. Iván López Named SPE Director of Technical Programs

Dr. Iván D. López has been appointed as new Director of Technical Programs at SPE. In this role, Dr. López will create new virtual and in-person education events, identifying subject matter experts and growing SPE’s portfolio of technical programs.

“Dr. López’s established experience of working in polymer sciences will be key to developing innovative programs and educational opportunities for our members and for those in the plastics industry,” said Patrick Farrey, CEO of SPE. “With his expertise in management, research and development, consulting and teaching in the polymer sciences, we are looking forward to utilizing his abilities to grow SPE’s footprint in plastics education.”

Dr. López earned his Ph.D. in 2009 from the University of Wisconsin-Madison with a major in Mechanical Engineering and a minor in Engineering Mechanics. He is a researcher and scientist with a demonstrated history of working in management, research and development, consulting and teaching in polymer materials, polymer processing, circular economy, sustainability, computational modeling, intellectual property, and plastics products.

Previously, Dr. López was Technical and Scientific Director at the Plastic and Rubber Research Institute (ICIPC) in Medellin, Colombia, where he obtained public and private funding to guarantee ICIPC operation and growth for 2020 and 2021, during the COVID-19 pandemic, including funds from United Nations Industrial Development Organization (UNIDO), Programa de las Naciones Unidas para el Desarrollo (PNUD), the Ministry of Industry, the Ministry of Environment, and others.

Dr. López designed and implemented research, knowledge transfer, and innovation strategies for ICIPC and plastics-related industry. He led and coordinated the research and lab team and networked successfully between ICIPC, industry, government entities and academia resulting in partnerships in research and science. Other roles at ICIPC include Technical Director, Technical Subdirector in Polymer Product Development, and Research and Teaching Assistant.

Dr. López’s research production includes three patent applications, two design patents, six software tools, more than 50 publications in scientific journals and conference proceedings and was lead researcher in more than 15 scientific projects.

“Educational programs are an important factor leading to the success of the society’s overall growth, particularly when it comes to professional development for SPE’s members,” said Dr. López. “I am looking forward to working with SPE’s staff, Executive Board and membership to achieve the society’s educational goals.”

Dr. López’s started with SPE on October 1st.
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