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PLASTISCOPE

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FROM THE PRESIDENT's DESK

Mr. Dilip Parekh

OPP

CONTENTS

Dear Members,

Greetings from Organization of Plastics Processors of India!

As I Write to you, there is an atmosphere of optimism and hope for better times. Many factors are responsible for this feeling of happiness.

Rains have arrived after an anxious wait because of conflicting predictions by various agencies. It is hoped that the Rains are normal resulting in increase of agriculture output, industrial and commercial activities. Good Rains augur well also for the Plastic Processors producing pipes, micro-irrigation etc.

PLEXCONNECT 2023 was held from 15th to 17th June 2023 at Nesco, Mumbai. This event was supported by Organization of Plastics Processors of India. Large number of Foreign Buyers visited OPPI Stall at PLEXCONNECT 2023. The Foreign Buyers were given information about the Indian Plastics Industry, Indian Producers of various value added Plastic Products they were searching for etc. Thus OPPI Stall at PLEXCONNECT 2023 utilized its presence for boosting Exports of Plastic Goods from India.

In case any OPPI Member wants to locate Foreign Buyers for Products produced by them, OPPI Secretariat can assist them in their search of Foreign Buyers.

I once again appeal to all OPPI Members to block the evening of 4th August 2023 and attend the Annual Meet. I can assure you that the talk by Mr. Sunil Kant Munjal on – "Managing Transition In A Family Owned Business" will help them to come out of the dilemma. Kindly register yourself by mailing the names of your nominees to secretarygeneral@oppindia.org;

With Best Wishes,

Dilip Parekh
President

Printed, Published and Edited by:
DEEPAK LAWALE on behalf of **ORGANIZATION OF PLASTICS PROCESSORS OF INDIA,** Printed at **DESIGN WORLD CREATIONS,** Unit No. 204, A-Wing, Suashish IT Park, Off. Dattapada Rd, Borivali East, Mumbai - 400 066 and Published from ORGANIZATION OF PLASTICS PROCESSORS OF INDIA, 404/405, Golden Chambers, New Link Road, Andheri (West), Mumbai 400 053.
Editor: **DEEPAK LAWALE**

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8500T

Ultra-Large Injection Molding Machine

01
Injection compression molding (ICM) technology

02
Internal circulation two-platen clamping unit

03
Smart Clamp technology

04
Closed-loop pump technology

05
Thick-wall injection molding technology

YIZUMI 8500T injection molding machine incorporates cutting-edge technologies in the industry, including injection compression molding (ICM) technology, Smart Clamp technology, internal circulation two-platen clamping unit and closed-loop pump technology special for optical products. It will solve the difficulties in the integrated molding of ultra-large plastic parts, fueling the growth of automobile, aerospace, ship, and other industries.

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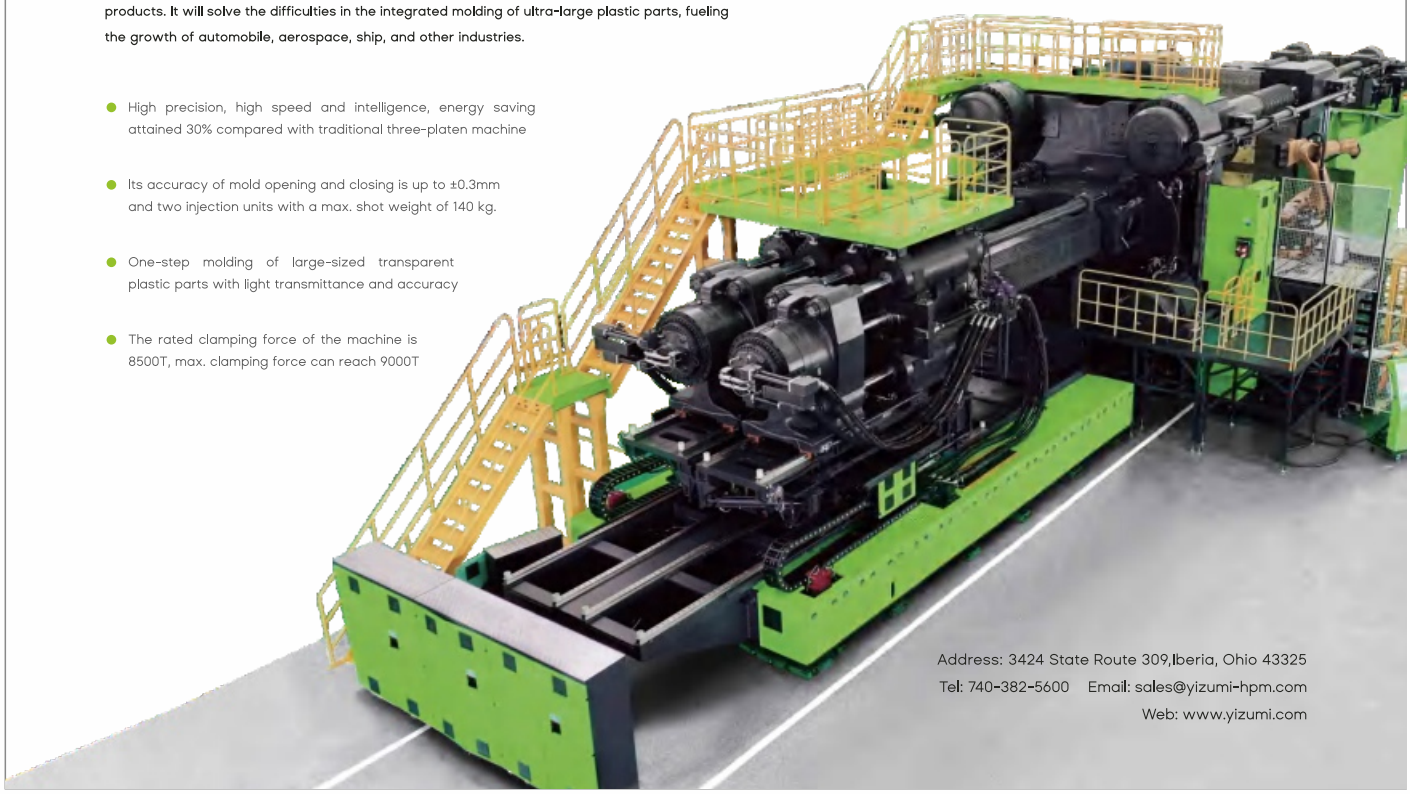

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The 16th Bangladesh International Plastics, Packaging and Printing Industrial Fair

24th - 27th January, 2024

Venue : Int'l Convention City Bashundhara (ICCB)

Organizers : Yorkers Trade & Marketing Service Co., Ltd.
Bangladesh Plastic Goods Manufactures & Exporters Association

[Exhibit Profiles]

- Plastic: Plastic Bending Machinery, Blow Molding Machines, Extruding Machines, Plastic Compounding Equipment, Plastic Cutting Machines & Cutters, Die Cutting & Casting Machines, Plastic Dryers & Mold Heaters, Injection Molding Equipment, Mold Cleaning Equipment, Spin Casting Equipment, Thermoforming Machines.
- Plastic & Rubber Raw Material & Auxiliaries
- Rubber: Rubber Bending Machinery, Mixing & Refining Machines, Product Molding Equipment, Press & Molding Equipment.
- Quality Detection Instrument and Equipment: Measuring & Detection Equipment, Temperature Controller & Components, Electronic Automatic Instrument, Monitoring Device.
- Machinery Parts and Accessories
- Packaging: Converting Machinery, Packaging Machinery, Packaging Materials, Raw Materials & Auxiliaries, Fiberboard Packages, Paper Bags and Folding Cartons, Rigid Packages, Glass Bottles & Tin Cans. Flexible Packaging, Quality Control Systems, Dosing, Coding & Marking Systems, Physical Distribution Systems, Logistics, Research Centers, packaging Magazines & Associations.
- Printing: Printing Machinery & Accessories, Packaging Print & Process Systems, Printing Materials & Supplements, Post-Printing Machinery & Equipment, Coating Equipment, Silk Screen Printing, Pre-Printing Systems, Envelop Making Machines, Inks, Ink Formulating Systems.

[Booth Prices]

✱ **Corner fee: Surcharge 10 %**

✱ **The prices above exclude VAT by 5%**

Shell Scheme: USD$ 320/sqm (Min.9sqm=3m x 3m= 9 sqm) = USD$2790
9 sqm including : carpeting, 3 folding chairs, 1 lockable counter, 1 round table, 3 spot lights, 1 waste basket, wall partitions, fascia name, one 5-AMP power point

Bare Space: USD$ 290/sqm

Deepak Lawale, Secretary General, **ORGANIZATION OF PLASTICS PROCESSORS OF INDIA**

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VietnamPlas

21st Vietnam International Plastic & Rubber Industry Exhibition

18th to 21st October 2023

Saigon Exhibition & Conference Center (SECC), Ho Chi Minh City, Vietnam

We have the pleasure of inviting you to participate in Vietnam Plas scheduled from 18th to 21st October 2023 at Saigon Exhibition & Conference Center, Ho Chi Minh City, Vietnam

Show Report 2022

Countries	Booths	Visitors
19	540	13,700

Rising Demand for Plastics

Vietnam imports approximately 1.94 million tons of plastic.

Raw material worth US$ 2.86 billion

Participation Fees :

- ☑ Shell Scheme (Minimum 9 sqm): US $ 320/sqm.
- ☑ Including Needle Punch Carpet: Wall Partitions, Carpet, Company Fascia,3
- ☑ Folding Chairs, 3 Spotlights, 1 Reception Table, 1 Round table, 1 Dustbin,1 Single Phase 5 amp/220v Plug.
- ☑ Raw Space Only (Minimum 36 sqm) : US $ 290/sqm

Please fill up the contract form attached herewith and Emailscanned copy of filled Application form to secretarygeneral@oppindia.org

ORGANIZATION OF PLASTICS PROCESSORS OF INDIA

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ORGANIZATION OF PLASTICS PROCESSORS OF INDIA

37 YEARS OF SERVICES TO PLASTICS INDUSTRY

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DAY 2 - PLANT VISIT

JUNE 24th, 2023 | 10:00 AM - 01:00 PM

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NEWS FROM INDIA

Flex Films to Showcase a Wide Range of Technologically Advanced Packaging Films

Interpack is a premier trade show for the global packaging industry where companies present innovations along the entire value chain

Flex Films, the global manufacturing arm of UFlex Limited participated in Interpack 2023, held in Dusseldorf, Germany, from May 4 to 10, 2023.

Flex Films exhibited its wide range of BOPET, CPP, BOPP, Specialty, and Green Films, along with a miniature working model of a Multi-Layer Plastics (MLP) recycling plant and a video screening of a recycled polyethylene terephthalate (rPET) plant in action. Both these recycling plants have successfully demonstrated the company's technical expertise in recycling multi - layer plastic and PCR waste over the last three decades. In addition, the company displayed a wide array of injection molded products made from MLP recycled waste.

The company exhibited rPET films made from recycled PET resin with printed widths of 210 cm. A specialty product from Flex Films at Interpack 2023 will include BOPE opaque films, known for their durability and cost-effectiveness. Visitors were free to cut out an A4 sample from these BOPE rolls to experience its quality and durability.

Other films on display include BOPET films with high tensile strength, durability, and heat-resistance properties, which also have good gas-barrier features. In addition, BOPP films with high gloss and excellent clarity were also exhibited including UBB-M (ultra-high barrier), UHB-M (EVOH Met with High OD), B-UTX UTX (ultra-high barrier Alox BOPP film, both sides treated), B-TUH-M MET with high seal strength (1.5 kgs), High Barrier MET BOPP with Low SIT and TAF (SIT 12 anti-fog).

Flex Films has recently been conferred the 2023 Silver Award in the Technical Innovation category by the Flexible Packaging Association (FPA), USA, for developing Ultra High Barrier and High Metal Bond Metallized Polyester Films. Over the years, Flex Films has bagged several national and international certifications for its technological innovations and environmental sustainability. From BOPET films to BOPP films to CPP films to metalized and Alox-coated films, Flex Films is a forerunner in technical innovation and operational capabilities.

Coca - Cola India Launches 100% Recycled Pet Bottle for Packaged Water

With the support of ALPLA, Coca-Cola India has launched a new bottle made from 100% recycled PET (rPET) in Andhra Pradesh. This is a significant milestone because it is the first time that a 100% rPET bottle has been used in India for food or drinks. By delivering the rPET preforms, ALPLA's activities aim to support Coca-Cola's global goal of using at least 50% recycled material in all packaging by 2030. Currently, 90% of the company's packaging is recyclable and 15% of PET used is recycled globally.

The new rPET bottle was launched for the packaged drinking water brand Kinley, and is currently available in one-litre bottles. They are made entirely from recycled food-grade plastic, which is a significant milestone for ALPLA and Coca-Cola in India in their joint efforts to create a circular economy. This step was only possible after the Food Safety Standards Authority of India (FSSAI) approved the use of recycled PET in food packaging, subject to compliance with its guidelines, after a thorough review of food safety.

Reducing the ecological footprint

Recycling of PET bottles with technologies approved by the US FDA and the European Food Safety Authority (EFSA) keeps plastic in circulation and significantly reduces the need for new plastic production. The use of rPET bottles not only conserves natural resources, but also reduces our carbon emissions.

Dr S B P P Rammohan, managing director, Sri Sarvaraya Sugars, Franchise Bottling Partner of Coca - Cola in Andhra Pradesh and Telangana said, "This move towards using recycled PET in packaging, aligns with our government's vision of sustainable plastic use, and we are proud to be associated with the Coca-Cola System in India as the first movers in this sustainability initiative."

100% rPET bottles in over 40 markets

In December 2022, Coca-Cola Bangladesh introduced 100% rPET bottles, making it the first company in the South-West Asia (SWA) region to introduce Kinley water bottles with 100% rPET in two-litre packs. The Coca-Cola Company now offers 100% rPET bottles in over 40 markets.

"In addition to enabling Coca-Cola's vision of creating a World Without Waste, the launch is aligned with ALPLA's Global Sustainability targets. In 2018, ALPLA, as partner of the Ellen MacArthur Foundation, signed a Global Commitment. Our mission by 2025 is to produce 100% recyclable packaging with 25% recycled content on average, and this launch is a big step in that direction in India. We are proud to be associated with Coca-Cola and will continue to do everything it takes to enable a World Without Waste," said Utsav Dixit, head of Sustainability at ALPLA India.

Manali Petrochemicals Q4 net profit slumps 98% to ₹ 1.33 crore

Manali Petrochemicals Ltd.'s standalone net profit for the fourth quarter plunged nearly 100 per cent to ₹ 1.33 crore as rising input costs combined with a drop in revenues affected its profitability.

The Chennai-based petrochemical manufacturer posted a net profit of ₹71.94 crore during the fourth quarter of Fy22. In the third quarter of Fy23, the company's net profit stood at ₹63 lakh.

Revenue from operations, on a year - on - year basis, dropped by 26 per cent to ₹266 crore in the latest quarter as against ₹361 crore for the corresponding quarter of FY22.

The company's total expenses marginally went up to ₹ 269 crore (₹ 267 crore) during the comparable quarters.

"The company's performance has got affected by the global macroeconomic situation as higher raw material costs and the inability to pass on the increase to the customers has impacted the bottomline," Ashwin Muthiah, Chairman, Manali Petrochemicals and Founder Chairman of AM International, Singapore said in an earnings release.

"We are looking at improving our operational efficiencies and focusing on margin improvements," he added.

At a consolidated level, the company's net profit for Q4 Fy23 stood at ₹ 45 lakh against a net profit of ₹ 74 crore in the year - ago quarter. Consolidated revenues came down to ₹ 334 crore (₹ 414 crore) during this period.

Tamilnadu Petroproducts Records Highest Revenue In F Y 2023

Financials :

TAMILNADU Petroproducts Ltd (TPL), Chennai based petrochemical manufacturing company and part of AM International, Singapore, recently announced its annual results for FY2023. During FY 22-23, TPL's revenue improved by 19 percent compared to

the previous financial year. The company earned INR 1818.37 crore during FY 21-22. Net profits registered at INR 89.31 crore as compared to INR 170.64 crore in FY 21 - 22. During the last quarter of the year, on gross revenue of INR 486.93 crore, operating profits were INR 20.52 crore and net profits were INR 12.93 crore. The operating performance reflects a contribution due to TPL's good product mix amidst intense competition from cheaper imports and higher energy and input costs. The Board of TPL has recommended a dividend of INR 1.50 per share (15 percent) for FY 22-23, subject to the approval of the members.

Diyani Engineering: Revolutionising the Bagging Conveying and End of line Equipment for the Polymer Industry

Diyani Engineering is a company that has been in business of manufacturing the bagging machine and conveying equipment from 2007. With in - house well - equipped design, latest software and manufacturing facilities, Diyani Engineering has been providing state - of - the - art solutions to the plastic and polymer industry.

As the demand for packaging machinery increases, companies are looking for reliable and efficient solutions that can handle high volumes of packaging with ease. This is where Diyani Engineering comes in, providing innovative solutions that are tailored to meet the specific needs of each customer.

Leading the team at Diyani Engineering is Mr. Jitendra Bhojak, a seasoned professional with over 25 years of experience in the technology of packaging and conveying systems. Mr. Bhojak has previously worked with some of the most reputed companies in the industry, including L&T and HUL, where he honed his skills in designing and installing high - quality automation and packaging solutions. As the business head of Diyani Engineering, Mr. Bhojak brings his vast experience and knowledge to the table, ensuring that the company continues to deliver cutting - edge solutions that meet the evolving needs of the industry. Under his leadership, Diyani Engineering has grown from strength to strength, earning a reputation as one of the most innovative and reliable suppliers of packaging machinery and conveying systems in the market.

Diyani Engineering serving within three business vertical, Packing, Conveying & End of line Automation. The company's range of bagging machine includes, fully automatic, semi-automatic machines for any type of solid granules and powder material. These machines are designed to handle different types of packaging materials, such as woven sacks, paper sacks, jute bags, and bulk bags. They are also capable of handling different sizes and weights of bags, ranging from 5 kg to 1000 kg. One of the key features of Diyani Engineering's bagging machines is their accuracy and speed. The machines are equipped with sensors and controls that ensure accurate weighing and filling of bags, reducing wastage and maximizing efficiency. The machines can also operate at high speeds, allowing for faster packaging and increased productivity.

Pre Bagging material conveying by pneumatic and vacuum, screw feeder, belt feeder, up to silo. Post Bagging conveying line includes, Belt Conveyor, Roller Conveyor, Slat Conveyor up to ware house delivery. End of line Automation includes, sealing machine, stitching machine, check weigher, bag turner, metal detector, bag palletizer, pallet stretch wrapping and ware house automation. These machines are designed to transport materials from one location to another, minimizing manual handling and reducing the risk of injuries.

Diyani Engineering's conveying equipment is also designed to be flexible, allowing for customization based on the specific needs of each customer. The machines can be designed to handle different types of materials, including powders, granules, and flakes, and can be customized to fit into existing production lines.

Pioneering Innovation in Plastics and Packaging Machinery from SHYAM PLASTIC

Shyam plastic industries is known for being synonymous with innovation in the plastics and packaging machine industry. The company was founded in 1993 and has been setting new benchmarks in the field of blow moulding machines and PVC Extrusion Plants.

Located in Ahmedabad, with a state - o - the - art manufacturing facility spanning over 10,000 sq. mts., Shyam adhere to the highest quality systems and firmly believe in continuous improvement through innovation with the latest technology. They take pride in being the first company in India to introduce high - speed all - electric PET blowing machines capable of producing up to 24,000 bottles/ hour.

Our pristine series machines are designed by our own experience, knowledge and expertise. These are entirely designed and 'Made in India'. These machines adhere to international quality standards, ensuring consistent production, high quality, repeatability, user friendliness, and long life. The pre cise synchronization of multiple servo systems using high - end motion control makes our machines reliable, energy - efficient and highly productive.

Some of the salient features of Shyam machines include:

Servo technology – ensuring reliability, repeatability and power efficiency.

IIT Grad's Biodegradable Thermocol Prevents Stubble Burning

The expanded form of polystyrene has been a popular choice for decades now, and falls under the category of polymers. Thermocol is being sold in large quantities and used frequently, often finding its way to landfills and the sea after discarding.

Letting it decompose is considered a safer route compared to incineration. Studies indicate that the burning of thermocol releases toxic gases such as carbon monoxide and about 90 different hazardous chemicals. If you come in contact with these vapours, it can potentially affect your eyes and nervous system.

The question remains as to why thermocol is still used so rampantly, despite being a health and environmental hazard.

Arpit Dhupar, a 30 - year - old engineer from Delhi, is attempting to change this reality with a new biodegradable material that he has innovated as part of his venture Dharaksha Ecosystems.

Launched in 2019, the Faridabad - based initiative produces biodegradable packaging material out of crop stubble waste. This addresses two issues - pollution hazards in Northern India resulting from the burning of stubble, and increasing amounts of dumped thermocol in landfills.

The “exhilarating” journey began when Dhupar's nephew made a drawing that was a little different than usual.

'He painted the sky grey.'

Describing the innocent moment, Dhupar says the scenery his nephew drew had all the typical elements - the sun, the mountains, the sea, the birds and the sky. But he was a little taken aback when the boy coloured the sky grey - like the Capital's sky every year after stubble burning - as opposed to blue.

“We shouldn't live in a world where we have to explain to kids that the sky should be painted blue. It should be a given,” he thought. At the time, Dhupar was heading a startup that worked on creating usable material from the smoke emitted by diesel engines.

His nephew's painting gave him some food for thought, and Dhupar couldn't shake off the excitement of building a venture that could make the skies blue again.

The year 2019, he recounts, set the building blocks for what would one day be Dharaksha. During a sabbatical from work, Dhupar travelled through the remote villages of Punjab and Haryana to understand why stubble burning was such an evil.

Through interactions with the locals, he arrived at the conclusion that farmers want the stubble cleared off as quickly as possible from their lands, as it serves no purpose to them. Owing to high moisture content, the stubble cannot be used as fuel.

Dhupar came up with the idea of having baler machines compress and stack the stubble and keep it aside so that it would not be a nuisance to the farmers. He then began work on setting up the Dharaksha manufacturing unit, where the stacks of stubble would be brought in for processing. He was joined by Anand Bodh, a colleague and friend.

The packaging displays qualities such as being flame proof, moisture resistant and anti static, Picture source : Arpit

Cushioning a sustainable idea When Dharaksha was launched, Arpit had a goal to solve the stubble - burning crisis in North India, for which he came up with the idea of using mushrooms to degrade the stubble. But, soon, this idea led him to conceive a biodegradable material resembling thermocol.

Explaining how the dots connected, Dhupar says that when mushrooms are harvested, they leave compost behind - a mix of metabolites that do not degrade easily. “I did not want to create another problem while attempting to solve one,” he notes.

However, as the mushrooms were allowed to grow on the stubble waste, Dhupar began realising the mycelium (fruiting body of the mushroom) grew on the waste in such a way that it rendered strength to the structure.

“This wasn't a waste material, but could be a usable one. Through bio fabrication, we could use the stubble waste to create a material similar to thermocol, but one that was biodegradable.”

Dhupar spent the next several months getting a clear understanding of what the market needed, and how they could pitch their product to industries. It also allowed him ample time to understand the impact of replacing thermocol.

“Thermocol is worse than plastic, and it's shocking how little conversation there is around this material,” says Dhupar.

There is also the fact that while thermocol is 100% recyclable, the process to do so is expensive. Moreover, noted the Clean India Journal, waste pickers sell their waste to kabadiwalas by weight, not volume. And since thermocol is 95% air, “it does not make economic sense for them to bother collecting a bulky, but lightweight substance.”

'It was a play of many crucial factors.'

Elaborating on their process, he says that once the stubble is brought to the factory, it is sterilised, after which they add the mushroom culture. “The mycelium grows, forming a sort of interlocked structure that holds the material in place. This makes it strong, so no resin needs to be added. The mix is then put into the oven, where the mushrooms are neutralised.”

The resulting material has numerous properties, making it an excellent packaging material.

For starters, it is flame - proof and can hence tolerate laser engravings. It can also tolerate high moisture conditions and is anti - static - a quality that is crucial while transporting PVCs. Dhupar adds that its superior cushioning capabilities mean they can reduce the overall box size.

Each piece of the material produced, says Dhupar, “prevents 250 tonnes of thermocol from going into landfills”. The startup has procured over 250 tonnes of paddy stubble from 100 acres of farmland in Punjab and Haryana, wherein the farmers are paid a rate of Rs 2,500 per acre, he adds.

But even while the wheels of innovation are constantly turning, Dhupar says a challenge is matching up to speed with the production rates of thermocol.

“This material takes seven days to grow. It is like metabolism. However much we increase the amount of raw material we are feeding the fungi, there won't be a sudden growth spurt,” he notes.

Regardless, the startup has managed to clock a turnover of Rs 25 lakh in the last year, and sees an order of around 20 tonnes per month, their main clients being glass industries.

Among them, The Gourmet Jars is thrilled to have made the switch from thermocol to biodegradable packaging for their products.

Apeksha, a member of the team, says, "Packaging in eco - friendly materials is tough, as the products need to be shipped and with courier services, there is need for adequate protection. However, the great part about the material is that it is strong and good for the environment. This way, we save 7,619 litres of air per jar from being polluted."

Dhupar, meanwhile, is satisfied. "I started the venture with the aim of making the skies blue. I feel satisfied that we are making a difference," he says.

Bagla Group : Sustainable Packaging Options

BAGLA Group has offered a range of Eco friendly Products, which are sustainable and can be used in place of standard plastic packing tapes to customers passionate about the environment, and are interested in transitioning away from plastic.

Eco friendly Products 85% PCR tapes : BX - rPET tape is a Packaging tape made of Recycled Polyester Film coated with either Hot Melt Adhesive or Water based Acrylic Adhesive. Recycling Plastics helps to decrease the amount of plastic waste that enters landfills. By using PET that has already been in circulation, Bagla is offsetting the amount of new PET that needs to be created.

Easy printable tapes: BX - Ultra is an Easy Printable tape which can be printed directly on the surface using SIAT type flexographic machines without hazardous solvents and ink systems.

PLA Tapes: BX-PLA is a bio- based eco-friendly packaging tape made with polylactic acid film, also known as PLA film. PLA is 100% made from renewable feedstocks such as corn starch, tapioca roots, or sugarcane. The adhesive used is acrylic water based. Thanks to the smart choice of raw materials and its outstanding design, BX-PLA Tape is produced with a bio - carbon content of 98% and, consequently, a reduced carbon footprint.

PLEXCONNECT 2023

PLEXCONNECT 2023 was held from 15th to 17th June 2023 at NESCO, Mumbai. PLEXCONNECT 2023 was supported via ORGANIZATION OF PLASTICS PROCESSORS OF INDIA was allotted 9 sqm Booth on complementary basis.

OPPI Stall in PLEXCONNECT 2023

PLASTIC PRODUCTS AND NEW TECHNOLOGIES

VTT Creates a Biodegradable ECG Patch and Paves The Way to a More Sustainable Future for Wearable Electronic Devices

The new nano cellulose and carbon ECG patch aims to reduce the carbon footprint of plastics and electronics for one of the world's largest waste-producing sectors: healthcare. VTT is currently looking for potential partners to bring manufacturing to industrial scale.

VTT Technical Research Centre of Finland has developed a new sustainable electrocardiogram (ECG, also known as EKG) patch that is fully recyclable and made of biomaterials. The device is modular, so electronic components can be easily removed from the disposable patch and used again. The patch itself is made of nano cellulose and printed with carbon conductors and sensing electrodes. The biodegradable patch is made of VTT's new material cellulose e-skin, which replaces traditional plastic in wearable skin applications.

An ECG is one of the most established and popular ways to monitor heart condition. It is used to record the heart's electrical signal to monitor heart health and assess for heart conditions. Currently, ECG patches are composed of electrical components on a substrate made from fossil - based sources.

The global need for sustainable ECG patches is projected to grow rapidly in the next few years. The global ECG patch and Holter monitor market was valued at USD 1.2 billion in 2022, and is expected to expand at a compound annual growth rate of 20% from 2023 to 2030. The growing prevalence of atrial fibrillation, aging, and rising incidence of cardiovascular disorders increasingly drive the market's demand.

“The healthcare industry has one of the heaviest environmental footprints, and manufacturers are increasingly faced with regulations to make more sustainable products. Bio-based substrates like cellulose e-skin are promising alternatives to fossil-based ones. The tricky part is the fact that they need to possess certain properties like stretchability, tear resistance and moisture sensitivity. We're proud to say that with cellulose e-skin, we've created a new film with huge potential for use in the medical industry,” says **Mohammad H. Behfar,** Senior Scientist at VTT.

Healthcare accounts for 8% of total US emissions and remains one of the largest waste - producing sectors in the world. Plastic is used in medical supplies because it is very inexpensive to source and easy to sterilize. As a result, plastics account for 25% of the waste generated by hospitals. 91% of plastics are not recycled and end up in landfills or nature.

Meanwhile, in 2019, people discarded 53 million tonnes of electronic waste, and the number will increase by 38% by 2030. The rising demand for small and wearable electronics is largely responsible for the issue because many small and complex parts make recycling these items increasingly difficult. Less than 20% gets recycled.

“Ours is the first nanocellulose-based ECG patch with no plastic additives. The wider implications go beyond ECG as cellulose e-skin can be used in a wide array of wearable devices in the future. The film is strong, flexible, transparent, breathable and has good printability. Potential other applications could

be, for instance, in printed energy storage and harvesting devices," says **Aayush Jaiswal,** Research Scientist at VTT.

Hybrid wearable ECG patch consists of removable and reusable electronics and biodegradable single-use skin patch. The skin patch is made of plant - based materials (i.e. nanocellulose) which degrades in soil and repulps in water through a controlled process for easy recycling. Both the conductors and ECG electrodes, which are visible in the skin patch were realized using carbon ink.

In Europe, a major incentive for creating more sustainable medical products is the European Commission's Circular Economy Action Plan. It's one of the main building blocks of the European Green Deal which puts increasing pressure on manufacturers in all industries to create more sustainable products in the face of increased environmental taxation.

VTT is currently looking to team up with partners who are interested in industrial scale manufacturing of sustainable wearable electronics.

New Generation of Home-compostable Coffee Capsules from Alpla

In 2021, packaging specialist Alpla introduced its Blue Circle brand - an umbrella label under which the company could bundle the various biodegradable packaging developments it was working on. The first Blue Circle product launched by the company was an injection - moulded home - compostable coffee capsule.

Now, two years later, Alpla is rolling out a new generation of biodegradable coffee capsules for the Blue Circle brand. Produced from an unspecified new organic material derived from a source posing no threat to food or feed production, the capsules are designed to be recyclable, biodegradable and to offer improved barrier properties. The certified system consists of a capsule and a sealing foil, minimising the effects on the capsule contents and the migration of coffee aroma to the environment.

'Around the world, consumer behaviour is becoming more and more sustainable," said Nicolas Lehner, CCO at ALPLA. "We ...are developing the packaging solutions of the future. With the biodegradable coffee capsule, we are not only helping our customers achieve their sustainability targets, but are also acting in line with the new EU Packaging Regulation," he added, referring to the recent EU proposal that would make compostable packaging mandatory for tea bags, coffee pods, very light plastic bags and sticky labels for fruit and vegetables.

The capsules are injection - moulded at the company's own facilities. "The combination of the material, design and production process is key to the capsules' stability, leak tightness and barrier. Our technological expertise and experience result in the optimum solution for unadulterated enjoyment," said Lehner. The entire system, including sealing foil and contents, has been 'OK compost HOME' and 'OK compost INDUSTRIAL' certified by TÜV Austria. The Blue Circle coffee capsules can therefore be disposed of via home compost or in the organic waste bin.

De - Inkable, Recyclable Mono - Material PE - Pouch with Barrier Properties

Solution: Creating the pouch : In a breakthrough development, easier-to-recycle* mono-material PE pouch has been created that has similar properties to more difficult to recycle laminated pouches. The new pouch utilizes the latest polymers, inks, functional coatings, adhesives and conversion technology and is the outcome of a unique value chain collaboration of ExxonMobil, Henkel, Kraus Folie, Siegwerk and Windmöller & Hölscher. The innovation allows for pouches that can provide a high oxygen barrier, outstanding package integrity, excellent shelf appeal,

and can produce an almost colorless recyclate (see picture 1) after the removal of printing ink and the oxygen-barrier coating layer.

The blown film was produced by Kraus Folie with ExxonMobil resins and produced on a W&H VAREX´´ extrusion line with inline MDO (Machine Direction Orientation) unit. In order to help achieve outstanding packaging integrity ExxonMobil's latest generation of performance materials were used, including Exceed™ S, Exceed™ XP, and Enable™ performance Pes, Exact™ plastomers, and ExxonMobil™ HDPE. Deinking primer, print image and barrier coating were applied in one step using a W&H MIRAFLEX´´, a flexo printing press with a downstream unit. 2 types of deinking primers were used – a solventbased (SB) and a water-based (WB) primer from Siegwerk´s CIRKIT® ClearPrime product range. Either SB or WB primers can be used depending on the application and provide comparable delamination and de-inking results by applying industrial hot-washing conditions. Both can result in an almost colorless recyclate (see picture 1).

The barrier coating material used is available from Henkel as LOCTITE® LIOFOL BC 1582 and from Siegwerk as CIRKIT® OxyBar BC 1582. The barrier coating can be applied on both flexo and gravure presses at industrial machine speeds on various substrates, offering excellent transparency. Its compatibility with recycling has been confirmed by Cyclos-HTP. The resulting films were then laminated using Henkel's new solvent - free, 2 - component polyurethane laminating adhesive, LOCTITE® LIOFOL LA 7102 RE / LA 6902 RE. The system has been designed for monomaterial structures and has been recognized as meeting the RecyClass recycling guideline.

Siegburg (Germany) – In a significant development, a fully recyclable mono - material PE pouch that has similar properties to barely recyclable* multi - material laminated pouches has been created. The new pouches utilize the latest polymers, inks, functional coatings, adhesives and conversion technology and were the product of a unique value chain collaboration of ExxonMobil, Henkel, Kraus Folie, Siegwerk and Windmöller & Hölscher. The innovation allows for pouches that provide a high oxygen barrier, outstanding package integrity and excellent shelf appeal, and produces an almost colorless recyclate after the removal of printing ink and the oxygen-barrier coating layer, a press release stated.

Delamination and Deinking:

In order to produce a colorless recyclate, the delamination and removal of the printing ink and coating from the laminate structure is crucial. To this end, Siegwerk´s delamination / deinking primer technology was applied on a Windmöller & Hölscher Miraflex, a flexo printing press with a downstream unit.

Depending on the requirements, either solvent - (SB) or water - based (WB) primers from Siegwerk´s Cirkit ClearPrime product range are available. Applying industrial hot - washing conditions enables delamination and deinking of the pouch, giving an almost colorless recyclate.

High oxygen barrier:

Excellent oxygen barrier properties had been achieved through the use of Loctite Liofol BC 1582 RE, a recently introduced 1-component barrier coating from Henkel, and Cirkit OxyBar BC 1582 from Siegwerk. The coating can be applied on both flexo and gravure presses at industrial machine speeds on various substrates, giving excellent transparency. Its compatibility with recycling has been confirmed by Cyclos HTP and it also meets critical guidance by American Plastic Recyclers (APR).

To match these requirements, appropriate colored and white inks from Siegwerk were used.

Laminating Adhesive:

To improve recyclability, the partners used Henkel's new solvent - free, 2 - component polyurethane laminating adhesive, Loctite Liofol LA 7102 RE / 6902 RE. The system has been designed for mono - material structures and has been recognized for its compatibility with recycling as certified by RecyClass.

Package Integrity

Outstanding packaging integrity is achieved using ExxonMobil's latest generation of performance polyethylene such as Exceed S and Exceed XP, in combination with Exact materials in the sealant layer. The MDO-PE films had been developed by ExxonMobil and Kraus Folie, employing ExxonMobil HDPE

and Enable performance polyethylene, and produced on their Varex extrusion line with an inline MDO unit.

Shelf Appeal

High primer transparency combined with a consistent print quality and the inherent gloss of the ExxonMobil PE-based MDO film helps to deliver an excellent shelf appeal of the final pouch. Deinking primer, print image and barrier coating had been applied in one step using a Windmöller & Hölscher Miraflex with a downstream unit.

*The terms 'recyclable' and 'recyclability" are intended to refer to the potential for recyclability of full PE solutions designed and manufactured in accordance with recycling guidelines such as PRE RecyClass. Ultimate recyclability of full PE packaging will depend on a number of factors outside of the partners (W&H, ExxonMobil, Henkel, Siegwerk, Kraus) control including, but not limited to, availability of programs and facilities that collect and recycle plastic packaging within a given community.

95% PE-Based Barrier Packaging with Improved Recyclability* Potential and Uncompromising Package Functionality

ExxonMobil collaborated with Hosakawa Alpine, Kuraray and EVAL to create recyclable* barrier packaging with very high PE content without compromising on package integrity, functionality or optics. *Recyclable in communities where facilities and programs exist to collect and recycle plastic film

Challenge:

Production of recyclable barrier packaging with very high PE content without compromising on package integrity, functionality or optics.

Potential Solution:

Creation of 95% PE-based barrier packaging with good oxygen barrier and outstanding package integrity. The films were produced with ExxonMobil best in class resins, including Exceed™ XP performance PE and Exceed™ 2012 performance PE, together with EVAL™ EVOH resins. The films were extruded on an Alpine 9-layer barrier line. Exceed XP performance polyethylene resins can help to provide exceptional toughness, while the EVAL EVOH L171B resin can help to provide high barrier properties.

Result:

The combination of Exceed™ XP performance PE and EVAL™ EVOH resins can deliver outstanding package integrity, including more than twofold better performance on flex-crack and dart drop impact, together with puncture values comparable to that of polyamide (PA) containing barrier film. A solution based on Exceed XP 7052 can match the needle puncture performance of the PA-containing reference, while a solution based on a blend of Exceed XP 7052 and Exceed XP 7021 can deliver an improved needle puncture performance. Regarding package functionality factors, such as oxygen barrier – not shown in the graph due to space limitations – ExxonMobil data tells that it is comparable to traditional PA-containing barrier films; whereas for other critical aspects, like optics, Exceed XP performance PE-based solutions outperform the PA-containing barrier film in haze. In summary, using the latest generations of performance resins from ExxonMobil and EVAL, it is possible to create a 95% PE-based barrier package, without compromising on package integrity, optics and barrier properties.

TotalEnergies Corbion & Changsu Industrial Aim to Advance Adoption of Biobased BOPLA Films

The collaborators will work to develop and promote applications of biaxially oriented PLA.

TotalEnergies Corbion and Xiamen Changsu Industrial Pte Ltd (Changsu Industrial) have entered into a strategic cooperation agreement that will further advance the PLA. More specifically, they aim to work together in the market promotion, product development, and R&D of new technologies and applications of biaxiaslly oriented polylactic acid (BOPLA).

The collaborators are already working closely to bring sustainable solutions to the Chinese market. One key example is the development of BOPLA-based adhesive tapes made of

Changsu's BiOnly that will replace conventional fossil - based material and help provide a strong solution to the postal service in China. New regulations have already been announced to encourage the adoption of biodegradable materials in the country's postal service by 2025 with some cities aiming to achieve this earlier by the end of 2023. With the further tightening of the regulation, BOPLA-based adhesive tapes are expected to experience a wider adoption in the future and the strategic partnership between Changsu and TotalEnergies Corbion will undoubtedly inject further impetus into this development.

Changsu Industrial is a leading global player in high - performance specialty plastic films with a focus on three major product segments: new energy, biodegradable, and functional film materials. The development of BOPLA is a good example of strong collaboration between different players in the value chain. BOPLA is made with biobased PLA using biaxial stretching technology, making Changsu Industrial's BOPLA product BiOnly biodegradable and capable of significantly reducing the carbon footprint of packaging materials.

Said Changsu Industrial's v.p. Mou Qingying, "The bioplastic industry in China has seen tremendous growth with new technological breakthroughs in biobased materials after the country issued its manufacturing sector development plan known as Made in China 2025. These innovations will contribute to the worldwide green transformation and help China reach its goal of being carbon-neutral by 2060."

Said TotalEnergies Corbion's CEO Thomas Philipon, "With increasing needs for sustainable solutions globally, the partnership of Changsu and TotalEnergies Corbion is paving the way for the introduction of more PLA-based innovation to the world. It's a win-win-win for people, industry, and the environment,"

Latest Data on Bottled Water Shows Continued Strong Growth

We recently heard from the International Bottled Water Association (IBWA) that new data from the Beverage Marketing Corporation (BMC) shows that bottled water has "reached new peaks in both volume consumed and sales". IBWA has been an authoritative source of information on all types of bottled water—from spring, mineral, and purified to artesian and sparkling since its founding in 1958. BMC is a leading source of U.S. and global data and consulting for beverages ranging from bottled water and carbonated soft drinks, to beer, fruit beverages and new age beverages.

BMC's latest data shows that bottled water's total volume sold in 2022 was 15.9 billion gallons, its highest volume ever, surpassing carbonated soft drinks for the seventh year in a row. In terms of retail dollars, 2022 sales approached $46 billion, up from $40.8 billion in 2021. For more than a decade, consumers have been increasingly choosing bottled water instead of less-healthy packaged drinks. Bottled water's volume surpassed soft drinks for the first time in 2016 and has done so every year since.

According to BMC's editorial director John G. Rodwan, "Numerous qualities account for bottled water's unceasing resonance with U.S. consumers, including its associations with healthfulness, convenience, safety, and value. Consumers' thirst for beverages that offer benefits beyond refreshment alone also contributed to the fundamental hydrating beverage's rise in the beverage standings. Bottled water's zero-calorie status and its lack of artificial ingredients appeal to many consumers. Even where tap water may be safe and readily available, people may prefer bottled water, which they often believe tastes better."

Americans consumed, on average, 46.5 gallons of bottled water in 2022, compared to 36 gallons of soda. Consumer demand for bottled water has significantly contributed to the industry's growth (30% since 2012), as people continue to switch from other less - healthy packaged drinks to bottled water. So much so, that nine out of 10 Americans (91%) want bottled water to be available wherever other drinks are sold, according to a survey conducted on behalf of the IBWA) by The Harris Poll.

Said IBWA's v.p. of communications Jill Culora, "People are choosing to drink bottled water because it is a healthy beverage choice, having zero calories and no caffeine or additives, and it has the added

benefit of packaging that is 100% recyclable. Not only are bottled water containers 100% recyclable (including the cap) but they also use much less plastic than soda and other packaged beverages."

While the health benefits are a definite factor in opting for bottled water vs. other beverages as shown by the data, this editor and her colleagues respectfully have doubts, at least for the time being, about the latter part of Ms. Culora's statement. As colleague Matt Naitove put it, "I don't imagine that anyone chooses bottled water over a carbonated beverage because the water bottle uses less plastic." Still, IBWA shares some interesting data and comments that pertain to recyclability of plastic water bottles.

- On average, soda containers use 252% more PET plastic than bottled water containers (22.2 grams vs. 8.8 grams for 16.9-ounce containers). Soft drinks and other sugary beverages need thicker plastic containers due to their carbonation and/or bottling processes.

  Even with continuing growth and increased consumption, bottled water still has the smallest impact on the environment — thanks to the fact that it has the smallest water and energy use footprint of any packaged beverage. On average, only 1.39 liters of water (including the 1 liter of water consumed) and 0.21 mega joules of energy are used to produce 1 liter of finished bottled water.

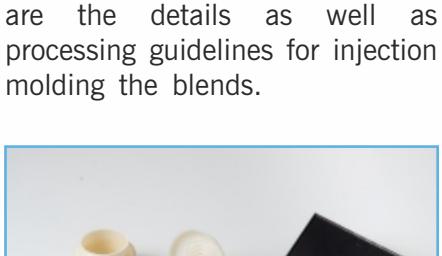
- Most bottled water is packaged in 100% recyclable PET and HDPE, plastics most recognized by consumers as being recyclable and the most recycled plastics in the world. Bottled water's recyclability distinguishes it from other common plastic products that are truly "single-use," such as non-recyclable plastic items (e.g., straws, cutlery, and plates); certain food and goods packaging (e.g., film, heat-sealed and multi - layered laminate bags) and containers (e.g., non-PET, HDPE, and PC bottles and tubs). In addition, PET plastic bottled water containers are the most recognized by consumers as being recyclable, which is likely the reason why they are the most recycled containers in U.S. curbside recycling programs. PET plastic bottled water containers are a valuable resource because they can be recycled and used over and over again.

- Recycling facilities know that there is a huge industry demand for post-consumer PET and HDPE. Many bottled water companies use recycled PET and HDPE to create new bottles, which helps to reduce their environmental impact. Moreover, bottled water drinkers recycle more often than drinkers of other beverages. Of all the PET containers recycled through curbside collections systems, bottled water containers make up approximately 49%. Empty bottled water containers should always be returned or placed in a recycling bin, but when they are not, they make up 3.3% of all drink packaging that ends up in landfills, and only 0.02% of all landfill waste.

- Studies have shown that bottled water containers are also not a major source of ocean pollution and microplastics. The vast majority of ocean plastic comes from sources other than the United States. In fact, if the U.S. were to completely eliminate all plastic use, the effort would only result in a 0.25% reduction of ocean plastics, data from Oxford University's Our World in Data website shows. A striking statistic is that bottled water accounts for less than 1.58% of all plastics used in the U.S., which means we are talking about 1.58% of 0.25%.

Blend Amorphous PHA with PLA to Improve injection Molded Part Properties

Adding aPHA to PLA can boost a range of mechanical properties and expedite composting. Here are the details as well as processing guidelines for injection molding the blends.



Biopolymers such as polyhydroxyalkanoate (PHA) and polylactic acid (PLA) are versatile, compostable and biocompatible materials derived from natural resources such as corn, sugar beets and potato starch, and are excellent candidates for producing commercially compostable packaging materials. PLA

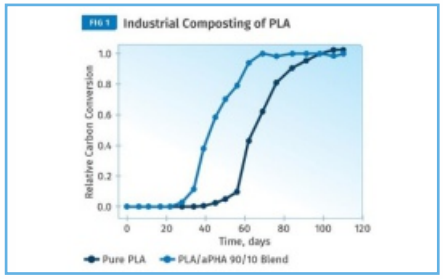
adoption has grown significantly in recent years, but some drawbacks — including low elongation at break and brittleness in comparison with traditional petroleum - based polymers — have limited the range of applications in which it is employed.

In this article we explore the use of amorphous polyhydroxyalkanoate (aPHA), which is commercially produced by CJ Biomaterials (a division of CJ CheilJedang), to improve the mechanical properties of brittle polymers such as PLA in injection molding applications. While modification of PLA is the focus here, a similar approach may be employed for a variety of other polymers used in molding applications.

What's a PHA?

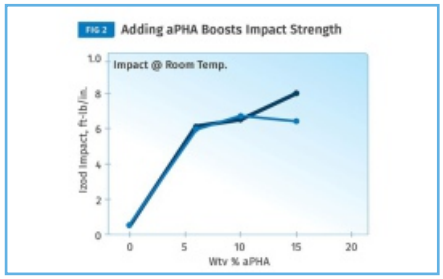
aPHA is a type of biopolymer that belongs to the family of PHAs, which are biodegradable aliphatic polyesters produced by various microorganisms as a means of energy storage. Unlike other types of PHAs, aPHA is a non - crystalline or amorphous polymer, meaning that it lacks the highly ordered structure found in semi-crystalline polymers. In 2022, CJ Biomaterials commercialized Phact 1000P aPHA, which has several unique properties that make it a promising material for various applications.

For example, its low glass-transition temperature (T_g) around -17°C leads to high stability and elasticity at low temperatures, compared with semi-crystalline PHAs in the market. The high biodegradability of aPHA is also one of its most remarkable characteristics. It is certified to be biodegradable in various environments, including soil and marine, by microorganisms that can use it as a carbon source.



The value of aPHA is to work with PLA or other biopolymers that are brittle and rigid.

As a result, it can be regarded as an attractive alternative to petroleum - based plastics. (It should be noted that the value of aPHA is to work with PLA or other biopolymers that are brittle and rigid, where it can help improve their performance and quicken their rate of composting compared with PLA alone.)



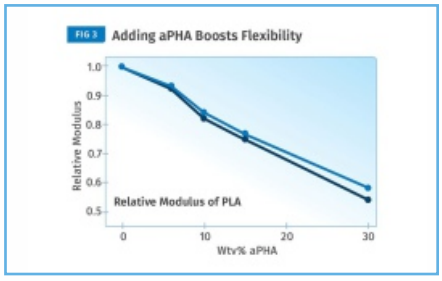
Addition of aPHA to PLA improves impact strength and ductility at room temperature. (The two different curves represent two different lots of aPHA.)

Photo Credit: CJ Biomaterials

Addition of aPHA to PLA results in the following advantages relative to pure PLA:

- Faster PLA industrial composting. As shown in Fig. 1, blending 10% aPHA with PLA permits composting times about 30 days faster.
- Considerable impact toughening of PLA. As shown in Fig. 2, aPHA can enable PLA to transition from a brittle polymer to a ductile polymer.
- Improved flexibility and potential for living hinges in molded parts. Figure 3 shows the influence of aPHA addition on the modulus of PLA.

Based on those performance features highlighted, it's clear that blends of PLA and aPHA are useful biobased (100% bio-carbon) and compostable alternates to plastics such as ABS, PP, PS, HIPS and PET in many molding applications. These blends are also certified for food contact by the U.S. FDA.



Adding aPHA to PLA improves flexibility and potential for living hinges. (The two different curves represent two different lots of aPHA.) CA1180P,

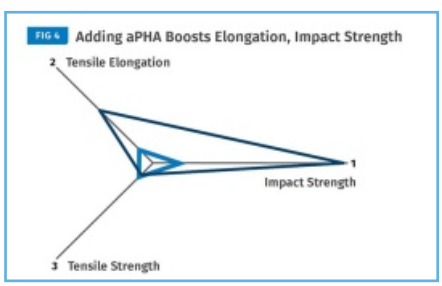
Photo Credit: CJ Biomaterials

Key Processing Considerations

To date, CJ Biomaterials has introduced two compounds for injection molding, CA1180P and CA1170P, which are based on PLA and aPHA along with a small amount of mineral filler. Their cost and performance are differentiated by the content of

aPHA and mineral filler. The spider chart (Fig. 4) demonstrates the performance of CA1180P relative to a standard PLA injection molding grade. It is evident that CA1180P, which is 100% biobased and compostable, has significantly higher impact strength and elongation relative to PLA alone, while only a modest decrease in strength is evident.

CA1180P can be processed on conventional electric and hydraulic reciprocating - screw injection molding machines. General process conditions are similar to those of PLA. Hydrolysis, thermal stability and warpage / shrinkage are among the factors that must be accounted for in molding both PLA and compounds of PLA with aPHA. Because aliphatic polyesters are susceptible to hydrolysis at typical processing temperature, the products must be dried prior to molding.



CA1180P, a blend of PLA and aPHA, has higher elongation and impact strength than pure PLA.

Photo Credit: CJ Biomaterials

These polymers are also prone to chain scission at higher than nominal processing temperatures that can arise from excessive shear. These attributes call for processing temperatures below ~200°C. The injection speed and screw rpm must be moderate. High - shear regions such as flow through the gate must be appropriately addressed through gate design.

Because aliphatic polyesters are susceptible to hydrolysis at typical processing temperature, the products must be dried prior to molding.

Other useful processing guidelines are as follows:

- Warping and shrinkage: PLA/aPHA blends have a relatively high coefficient of thermal expansion, which can cause warping and shrinkage of the parts during the cooling phase of injection molding. To minimize this, it is critical to use proper cooling methods, such as uniform cooling across the mold surface and adequate cooling time. And a slower than normal injection speed and additional holding pressure can help fill the part without much shrinkage and flash.

Mold temperature: This directly affects the cycle times. At a mold temperature of 30°C, the cycle time for CA1180P PLA/aPHA blend is 20–35 sec. On the other hand, more than 100 sec of cycle time is required for high-temperature molding (110°C) typically used for crystallizing the PLA in - mold.

Holding pressures and time: The second - stage injection pressure (i.e., holding pressure) should be just enough to fill the last 1% to 5% of the part and maintain a full part as it cools and shrinks in the cavity. For PLA/aPHA blends, holding pressure is typically 15% to 30% of the first-stage peak injection pressure and should start low and increase gradually until the part fills but does not flash.

The optimal hold time is the time that it takes the gate to seal off, at which point the weight of the part does not increase with further holding. For PLA/aPHA blends, hold times of 3–10 sec are common; longer hold times can be used for more complex parts. Sink marks and voids in the part indicate insufficient hold time.

General Process Conditions for Injection Molding of PLA/aPHA Blend

Injection Speed	10~25%
Drying Temperature	60°C x 5 hr
Feed Temperature	155-175°C
Compression Section	170 ~ 190°C
Metering Section	175~185°C
Nozzle Temperature	175 ~ 190°C

Photo Credit: CJ Biomaterials

- Cooling time: This should be long enough that the part ejectors do not penetrate the part. The part should not stick in the cavity and eject freely. The cooling requirements of a part are strongly dependent on its wall thickness. It is recommended to start long — e.g., 15–30 sec — to ensure the part can be ejected, and then gradually reduce the cooling time when the cycle is running. At a minimum, the cooling time will be equal to the screw recovery time.

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He is a Fellow of the Society of Plastics Engineering (SPE), has been recognized with the Research/Technology lifetime achievement award by the SPE, and is an alumnus of the NAE Frontiers of Engineering. Contact: (339) 999 - 2693; *raj@krish.cj.net;* ***cjbio.net.***

Eunhye (Grace) Lee is the group manager of polymer application R&D at CJ Biomaterials. She has a Ph.D in polymer engineering from Osaka University and over 10 years' experience in research on biopolymers. In particular, she has led application studies on biopolymers such as PLA, PHA, and PGA. She recently published several papers on the behavior of polymer properties and the use of biopolymers.

Eunhye is currently conducting research on improving the physical properties of PHA biopolymers and compounds including tuning rates of biodegradability.

At CMPL Expo in Mumbai, 3D Neopac to Introduce Tubes with Locally - sourced PCR Content

3D Neopac, a global provider of tube packaging for cosmetics and health care, and the India-based subsidiary of Hoffmann Neopac of Switzerland, introduced a range of post-consumer recycled content tubes sourced from an India-based material supplier at the **Contract Manufacturing & Private Label Exhibition**, May 4-5 in Mumbai.

The company showcased an extension of its EcoDesign portfolio that can comprise up to 28% PCR content, and is available in diameters ranging from 19-50 millimeters.

To produce the new tubes, mechanically recycled materials are sandwiched between layers of conventional polyethylene. As soon as this summer, 3D Neopac's India - based PCR materials supplier is aiming for FDA-NOL certification, which would allow product contact with the material and hence to add an EVOH barrier to the PE tube for enhanced protection of the formulas.

A prominent India-based skin, hair and oral care products provider, ARATA, has already agreed to utilize 3D Neopac's new PCR tubes.

"3D Neopac is excited to offer these new recycled content tubes, which we believe will take substantial strides toward our circular economy efforts, and serve as an encouraging example of plastic waste reduction in India," said Anant Gadre, Managing Director of 3D Neopac. "We also are proud that a well-known, forward-thinking personal care products company like ARATA has agreed to utilize these new PCR tube solutions."

The new tubes join an ever-growing family of Neopac Group's sustainability-minded EcoDesign products, including PaperX fiber-based Tube, which drastically reduces both plastic materials use and overall carbon footprint; and a Lightweight range offering thin-walled tubes and SlimLine caps.

PLASTIC RAW MATERIALS

Polystyvert Announces The Construction of its First Full-Scale Commercial Plant to Produce Recycled Polystyrene in Greater Montreal

Representing an investment of USD40 million, this plant will recycle 9,000 tons of post-consumer and post - industrial polystyrene waste annually, with a high degree of contamination. This amount is equivalent to 15% of the polystyrene buried in Quebec each year.

Among the partners, it is important to note the participation of two blue-chip partners in the polystyrene industry who will contribute to the financing of the plant. The supply of raw materials is ensured, as well as the sale of recycled polystyrene.

Polystyvert's patented technology addresses an essential need in waste management, namely the ability to recycle a material that was once considered difficult to recycle. Thanks to advanced purification, it is now possible to remove contaminants and produce high-quality plastic. This recycled plastic exhibits identical physical and chemical characteristics to virgin resin, while also allowing a reduction in greenhouse gas emissions of up to 90%.

The recycled resin can be used to manufacture products intended for the same applications as virgin resin. In line with Quebec's and Canada's economic and environmental objectives, this transformative project benefits from the support of both levels of government.

We remind, Montreal - based specialty recycling company Polystyvert has closed a round of funding to facilitate the development of a full - scale polystyrene (PS) recycling plant. The round includes new investor BEWI Group, a European provider of packaging, components, and insulation solutions, and said to be one of the largest integrated expandable PS (EPS) producers in Europe with an annual EPS production capacity of 200,000 tons, as well as new private investors.

MBA Polymers UK launches Post Consumer Acrylonitrile Butadiene Styrene Product

Manufacturers in electronics, automotive and cosmetics industries are among those demanding more high-quality recycled ABS amid increased global demand for lower carbon products.

MBA Polymers UK has launched a new ABS (Acrylonitrile Butadiene Styrene) product, ABS 4125 UL. The company claims that the UL certified product provides a recycled alternative to the plastics used in electronics, automotive manufacturing and consumer goods, reducing the demand on the Earth's depleting resources.

The breakthrough was achieved by leveraging technical developments in MBA Polymers UK's plastic recycling operations at its facility in Worksop, Nottinghamshire.

With manufacturers operating in a market where the demand for recycled ABS outstrips supply, MBA Polymers UK is already exporting its new product to businesses globally including the USA and Hong Kong.

ABS 4125 UL is the first of a new range of premium-recycled polymers to be launched by MBA Polymers UK. By 2030, the company's target is to deliver 100,000 tonnes of recycled plastics content to manufacturers in a range of markets and industries, including high-performance polymers such as ABS.

MBA Polymers UK is part of EMR, which recycles around 10 million tonnes of materials each year. MBA Polymers UK claims it benefits from a reliable, high-quality feedstock including end-of - life vehicles, household appliances and the waste material from the construction industry.

The new ABS product is derived from the fast - growing waste electronics sector, aiming to create a circular economy in the backdrop of increased regulation and growing consumer concern about the use of virgin plastics.

As well as benchmarking against the performance and specifications of other leading ABS polymers, MBA Polymers UK has also achieved UL accreditation for its new product. UL accreditation verifies the quality, safety and sustainability of recycled plastics, so that manufacturers, brand owners and end users feel confident in the performance and credibility of the materials.

Matte Finish for PET and rPET Molding and Extrusion Applications

Ampacet's new Modern Matte masterbatches are designed for mono, multilayer extrusion and in standard as well as heavy-wall molding applications.

A new family of color masterbatches said to create a high-impact luxurious finish for PET and rPET blow and injection molded applications and sheet products without the need for spraying, dipping, bead blasting or retooling, is newly available from Ampacet. Designed for use in mono, multilayer extrusion and in standard as well as heavy-wall molding applications, they are said to be ideal for applications such as personal care, cosmetics, beverages, spirits, automotive, industrial, and home care products, with custom color matching available upon request.

Modern Matte masterbatches are said to also eliminate scrap and waste resulting from traditional secondary processes and are available in three finish and texture options: Clara, a subtle delustering effect with a smooth finish; Textura, which combines a luxurious matte finish with a textured surface; and Prima, designed for increased tactility and enhanced scuff resistance at high LDRs.

Ampacet Introduces Pet Uva: Uva Protection for Clear Pet Packaging

Ampacet, a global masterbatch leader, introduces PET UVA, an FDA - approved masterbatch that protects packaging contents from damaging UV light, keeping food fresher, prolonging product shelf life and reducing waste. It also preserves the integrity of contents in clear PET and rPET packaging for personal care and household products. Ampacet also offers UVA in PE and PP.

PET UVA, for blow molding, film and sheet extrusion processes, offers excellent clarity and UVA protection, with transmission of less than 10% at 13 mils up to 390 nm with a 1% LDR. It significantly reduces the cost of UVA protection for PET packaging by providing benefits with LDRs of .4 to .8%, depending on performance requirements.

Ampacet UV Absorbers (UVA's) keep package contents fresher and prolong shelf life to help reduce waste. They are designed for use in PP, PE and PET for food, beverages and non-food packaging and are available in a wide range of molecular weights and structures suitable for almost any application. Ampacet UVA masterbatches support customer sustainability goals by reducing food waste and are compatible with PCR and support recyclability.

100977 PE is an FDA-approved UVA masterbatch that offers similar functionality for PE, but usage levels and applications may vary.

7000163-N PET UVA is an FDA-approved masterbatch compatible with most standard PET grades and rPET.

CrystalClear is an FDA-approved UVA masterbatch for PET that offers exceptional clarity for cosmetics and personal care packaging. The low LDR can reduce the cost of UV protection

by as much as 40%. CrystalClear functions in ISBM, film and sheet extrusion. For more information about Ampacet UV Absorber masterbatches and other R3 Sustainable Solutions, their applications and complete Regulatory Status, please complete the product inquiry form or contact Ampacet or your local Ampacet representative.

Avient and BASF Collaborate to Bring Colored Ultrason® to The Global Market for High-performance Polymers

Avient Corporation and BASF are now collaborating to offer colored grades of Ultrason® high-performance polymers to the global market. The colored grades feature BASF's Ultrason® polyarylethersulfones (PAES) as high - quality base polymer combined with Avient's Colorant Chromatics™ high- temperature color formulation expertise for color concentrates and pre - colored solutions.

The collaboration will offer customers in industries such as household and catering, electrical & electronics (E&E), and healthcare a distinctive benefit by providing comprehensive technical support from the base polymer to the final - colored product. As a result, customers will be able to react more quickly to design trends, meet technical requirements as well as color standards, and thereby increase speed to market. The full-color Ultrason® portfolio can also help contribute to a more sustainable lifestyle by enabling reusable, high - quality, and stylish household and catering articles.

Products can be reused by consumers and recirculated by caterers many times while maintaining performance and design. Thus, they support a circular economy, avoiding single-use plastics and reducing packaging waste caused by conventional catering, take-away, and to - go articles.

“The market requirements for colored, high - performance polymers are clear: you have to react quickly and also be able to supply various volumes of colored material,” says Anne Hippert, general manager, Colorant Chromatics at Avient. “With this collaboration, we can offer the best of both worlds in high - performance polymers. Avient is well - known for its specialized color solutions, respecting the customers' final application requirements, and BASF is well - known for its excellent Ultrason® quality and broad material competency.

Together, we are committed to bringing innovative PAES to the market, meeting color challenges across multiple industries, including the household and food industry, where we see the use of Ultrason® as a perfect fit for our customers' sustainability efforts by promoting appealing colors for reusable and safe applications.”

“Avient's Colorant Chromatics business is known for being a strong and agile color solution provider for specialty polymers while BASF is a well-recognized producer of high - quality Ultrason®,” says Florian Hennenberger, global business development Ultrason® at BASF.

“By working together, we can now offer customized colors with Ultrason® as a base material to existing and new customers. By combining the global networks of both companies with the color formulation expertise of Avient and the broad material competency and portfolio of BASF, this collaboration will lead to smoother and less complex product development for our customers.”

Avient and BASF have a long history of collaboration in the field of PAES. Through this next stage of cooperation, the companies can more readily meet the demand for various-sized orders with short lead times, with the capability to serve different industries. The colored grades will be formulated and sold by Avient as Colorant Chromatics™ made with Ultrason® by BASF.

Tracing the History of Polymeric Materials -- Polyurethane

This material family has unparalleled versatility, not only in terms of the forms the material can take, but in the different ways in which it can be processed.

In the same era when Wallace Carothers was conducting his experiments to synthesize polyesters and nylon at DuPont, a German chemist, Otto Bayer, was investigating another type of reaction using some of the same chemistry, but introducing a new constituent called an isocyanate to create the materials that would become polyurethane. Bayer received his doctorate in 1924 from the University of Frankfurt and entered industry with IG Farben, the German dyestuff conglomerate. Because the Bayer Corporation was one of the companies involved in the IG Farben group, it is often assumed that Otto was related to the Bayer family that founded the company. However, there is no such familial relationship.

By 1931 Otto found himself at the helm of the Central Research laboratory in Leverkusen, where he began investigating the chemistry of reactions involving the remarkably reactive isocyanate functional group. Over a period of several years, he succeeded in developing a reaction between hexamethylene diamine, one of the monomers used to make nylon 66, and hexamethylene diisocyanate, to form the first of a family of materials that today are collectively called polyurethanes. This technology was patented in 1937.

A year later, Heinrich Reinke, a member of Bayer's team, developed an alternate route to polyurethane synthesis that is more typical of the current technology. Reinke reacted butylene glycol, the same material used to make PBT polyester, with another diisocyanate. Both of these diisocyanates were aliphatic in structure and the molecular weight of the resulting materials was relatively low. But this reaction was the beginning of the creation of what is arguably the most versatile chemistry in polymers.

The first product of this research was polyurethane foam, and there are pictures of a smiling Bayer looking at the fruits of his efforts, a large mass of foamed material. The early foams were created by accident. Moisture reacts readily with isocyanates, forming a substance called carbamic acid, which is unstable and rapidly decomposes into an amine and carbon dioxide. The carbon dioxide acted as a foaming agent and therefore it is not surprising that polyurethane was first introduced commercially in the form of foams. Free carboxylic acid groups in the polyesters that were reacted with the diisocyanates also contributed to carbon dioxide production.

Early PUR foams were created by accident.

But it did not stop there. The foams could be rigid or soft depending upon the level of volatile gas generated during production. Over time, this was controlled better by reducing moisture levels and intentionally introducing other gases as the foaming agent. The first foams were of the soft variety, but by the mid-1950s rigid foams were commercialized and found immediate use in building and construction.

Boosting the Molecular Weight

It was also discovered that polyurethanes made excellent adhesives and sealants as well as coatings for materials like hardwood floors. For all of these purposes, products could be fabricated without being too concerned about molecular weight. For fibers, and especially for molded elastomeric parts, the considerations of molecular weight became more important. While Bayer is credited with the discovery of polyurethane chemistry, his materials were based largely on aliphatic reactants and would be properly classified as polyureas.

Research on boosting the molecular weight of polyurethane polymers started as early as 1941 at DuPont. This work was done by William Hanford and Donald Holmes, who received a patent on the process of making polyurethanes in 1942. Hanford and Holmes discovered the chemistry of including long-chain diols, called polyols, into the polyurethane chemistry. This increased chain length and improved control over mechanical properties. Longer chain polyols produced softer materials since these groups represented the soft segments of the structure while shorter chain polyols created harder materials. Today, polyurethanes can be produced with hardnesses that range from 55 to 60 on the Shore A scale up to 75 on the Shore D scale. Initially, the polyols were based on polyester chemistry.

As is so often the case, world conflict both catalyzed development and produced immediate applications. The elastomeric character of polyurethane led to its use as a substitute for natural rubber, which was often difficult to obtain from areas of the world steeped in throes of World War II.

Development continued after the war. By 1952, high-molecular-weight polyurethanes became available based on a reaction between polyester-based polyols and an aromatic diisocyanate, toluene diisocyanate (TDI). By 1957, rigid foam was being produced for insulation by the French glass manufacturer Saint-Gobain.

Versatility of polyurethanes: (2) Rigid foam pipe insulation. (Photo: Covestro)

This same era also saw the development of polyurethane foam for surfboards. Also at this time, polyether-based polyols were introduced as an alternative to polyesters. Polyethers offered improved resistance to hydrolysis while polyesters tended to have better mechanical properties. Both of these options exist today, along with polycaprolactones and even polycarbonate. The first polyether, polytetramethylene ether glycol (PTMG), was introduced by DuPont in 1956 and also became a key component in the chemistry of copolyester-based thermoplastic elastomers, trade-named Hytrel. In the following year, Dow and BASF developed chemistries based on PTMG reacted with methylene diisocyanate (MDI) and ethylene diamine. DuPont created a fiber from this chemistry that became known as Lycra Spandex. ecame known as Lycra Spandex.

By 1962, materials exploiting a wide variety of these chemistries were being produced that could be molded into standalone products. These could be thermoplastic or thermosetting depending upon the chemistry of the constituents. A singular benefit of these materials was outstanding abrasion resistance combined with a high degree of ductility. The crosslinked systems tended to outperform the thermoplastic variety, with better wear resistance and lower compression set.

Versatility of polyurethanes: (3) RIM semirigid elastomer. (Photo: Thieme Corp.)

Introduction of RIM

In 1967, Bayer exhibited a complete plastic car body in Düsseldorf at the K Show. Many of the panels were produced from a new process called reaction injection molding (RIM). This technology involved injecting the liquid constituents needed to create the polyurethane polymer into the mold and polymerizing the material in the mold at the same time the part was being formed. This was more of a proof-of-concept demonstration, but by 1983 it became a commercial reality when the Pontiac Fiero was introduced with an all-plastic body made of RIM panels. The polyurethane material had a limited modulus, and later enhancements involved placing glass mats into the mold that acted as reinforcing agents to stiffen the material. This became known as structural RIM (SRIM).

The combination of abrasion resistance and good low-temperature impact also made polyurethanes ideal for wheels on items like roller skates and skateboards. These were introduced in 1973. In the late 1970s I worked with a company that made screw conveyors where a metal chain runs over the gears. The gears are typically metal and the company wanted a plastic gear.

We started with an acetal homopolymer due to its reputation for wear resistance with good lubricity. The loss of material through wear was substantial. We then molded some gears from a Shore 45D polyurethane and they exhibited no significant wear after tests that ran more than 1000 hr. It was a real education in the properties of polyurethanes.

Even a cursory investigation into polyurethanes shows that the material family has unparalleled versatility, not only in terms of the forms the material can take but in the different ways in which it can be processed. This arises directly from the unique chemistry of this material family, which will be the topic of our next installment.

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Getting into Plastics Additive Manufacturing? Avoid these Six Common Errors

There are a lot of 3D printing technologies out there, and it's not uncommon for processors new to additive manufacturing to get tripped up. Here are some typical snafus, along with advice on how to avoid them before you start making parts.

Say you're on a tight deadline to design and print a part that's just right for your application. You've chosen 3D printing (aka additive manufacturing) to do the job because you know it allows for quick iterations, letting you tweak the part to your heart's content. But the last thing you need is to get tripped up because you don't have a solid knowledge of the technology you're using. There are a lot of printing technologies available, so unfortunately, it happens.

1. Process Choice Affects Dimensional Accuracy

Let's start with the issue we see the most. There are multiple 3D printing processes, and each delivers parts with different specs. While there are limited exceptions to some of the notes in this section, the most important thing to remember is that you should get to know the printing process first, before committing to it. Fortunately, the advancement of Industry 4.0 technologies has enabled automated design - for - additive - manufacturing (DfAM) to identify many of the most common issues as soon as you upload your CAD file.

- **Stereolithography (SLA):** If dimensional accuracy and high surface quality are important, SLA will get you there, but it's important to consider orientation to ensure proper feature formation. Knowing its limitations based on build orientation will help you better design parts for 3D printing.

SLA technology provides some of the best feature resolutions in the industry, but holes with diameters less than 0.020 in. (0.508 mm) could seal shut during the build. You should design internal channels to be at least 0.025 in. (0.635 mm) wide, and for slots, go with at least 0.015 in. (0.381 mm). There are specialized micro-resolution materials that allow holes less than 0.020 in. (0.5 mm), or slots less than 0.015 in. (0.381 mm), but not all manufacturers stock them.

Get to know the printing process first, before committing to it.

Be aware that you can only get the thinnest features in the draw plane (x, y), as opposed to the build plane (z). Think carefully about features such as support walls, inset, and embossed features (as on 3D-printed micromolds). Keep in mind that thin features that are longer or taller must be designed thicker to maintain strength.

Parts made through SLA using thermoplastic-like materials are an excellent choice for prototyping but lack strength and durability, so choose your material carefully. (Photo: Protolabs)

- **Carbon DLS:** The Carbon DLS (digital light synthesis) process uses light to solidify UV-curable resin into durable parts. It's good for complex designs with isotropic qualities (equal strength in all directions). When designing parts for this process, you should avoid overly thick walls, but they must be at least 0.040 in. (1.016 mm) thick. Anything less will result in features not fully forming or severely warping. Watch out, though: Since these walls are fairly thin, they can easily break in post - processing.

On the opposite end, we sometimes see walls that are too thick, which can result in stress - cracking or dimensional inaccuracy. It is important to try to keep most walls in the 0.040-in. to 0.125-in. (1-mm to 3.16-mm) range.

With SLA, thin features that are longer or taller must be designed thicker to maintain strength.

While structural walls need to be at least 0.040 in. (1.016 mm) thick, Carbon has excellent positive feature resolution — features defined by solidified resin. The minimum positive feature size is 0.020 in. (0.508 mm). This applies to features like small text and inset or embossed elements.

For negative spaces, we suggest that the minimum hole, channel or gap size be at least 0.025 in. (0.635 mm) because the resin is quite viscous — anything less would risk having the feature seal shut during the build.

Leveraging the strengths and knowing the weakness are key when choosing a 3D printing process. Carbon, for example, allows for complex designs but wall thickness must be considered. (Photo: Carbon)

- **SLS, MJF with nylons:** When printing with nylons using selective laser sintering (SLS) or Multi Jet Fusion (MJF), there are three important issues that need to be addressed in your CAD model. Common geometries that might be problematic include blind holes, threads and areas where internal diameters and tapers are near exterior walls.

a. **Wall thickness:** This refers to the thickness of part walls or geometries in any direction. The minimum allowable wall thickness is 0.030 in. (0.762 mm) in SLS and 0.020 in. (0.508 mm) in MJF.

b. **Channel gaps:** This refers to the distance between two features. Get too close and you'll have issues during the build. Because the sintering process can fuse two features together in locations that are close together, it's important to include channel gaps. We recommend minimum channel gaps of 0.030 in. (0.762 mm) for both SLS and MJF.

- **Knife-edging:** Although you typically want to avoid these very thin features in your designs, sometimes you need them, so you want to design them correctly. For example, think of a counter-bored hole. Your dimension may drop below the minimum feature size at the distal end of the hole. This could result in a shortened or round feature that does not form properly.

2. Avoid Low-Resolution STL Files

If you send your customer low-resolution STL files, you'll end up with parts with coarse faceting (surfaces like a gemstone). The parts will still be manufacturable but might not be desirable aesthetically. To avoid this issue, adjust your STL resolution in your export settings. Note that reducing angle tolerance usually has the greatest effect and improves resolution.

We recommend high-resolution STLs that are still small enough to be uploaded and manipulated (100 MB or less). Even better: submit a STP/STEP file and your manufacturer will likely convert it to STL on their end.

3.Preventing Warpage in SLS and MJF Parts

Put enough heat on certain plastics and they're likely to sag. Powder-based printing processes like SLS and MJF use heat to sinter powder together into a solid part, but the same heat that melds the layers together can also cause them to warp. It's all about part size and overall thickness. The bigger the part — 7 in. (177.8 mm) and larger is particularly difficult — the more likely the part is to warp. Also, thin parts with small feature sizes are more likely to warp. So, what can you do about it in your designs?

- Aim for uniform thickness of 0.080 to 0.125 in. (2.00 to 3.175 mm) to help ensure stability.

- Consider using glass-filled or mineral - filled nylon SLS materials, like nylon 12 with 40% glass or 25% mineral filler. These strengthen the part while lessening warpage.

- If your part is larger than 7 in. (177.8 mm), and you are concerned about warpage, consider other printing options than MJF, such as SLS or SLA.

4. Avoiding Inconsistent Shrink in SLS, MJF

Shrinkage can be a problem, too, especially when there is unequal distribution of material across the breadth of the part. It's all about cooling. Thicker areas of parts will cool and coalesce more slowly, and this can lead to undesirable part shrinkage.

Put enough heat on certain plastics and they're likely to sag.

If a thick feature is required on a part, consider hollowing the feature to a shell of approximately 0.100 to 0.125 in. (2.54 to 3.175 mm). If possible, match the overall thickness of your part to the large feature's shell thickness.

5. Carefully Choose Material for SLA Parts

Today's SLA machines use a range of thermoplastic - like materials, some of which can mimic popular and strong resins like PP, ABS and PC. But it's important to remember that these are thermoplastic - like analogues of popular thermoplastics, and can only emulate the properties of their molded counterparts. Generally, SLA parts are not as strong or durable as parts that are sintered, cast, machined or molded. Nevertheless, SLA is still an excellent choice to prototype parts that can validate form and fit — but not necessarily function.

	Materials	Max Part Size	Min Feature Size	Tolerances
Metal 3D Printing	Aluminum Stainless Steel (17-4, 316L) Titanium Inconel Cobalt Chrome	9.6 in. x 9.6 in. x 13.0 in X Line: 31.5 in. x 15.7 in. x 19.7 in.	0.006 in.	± 0.003 in
Stereolith-ography	ABS Polycarbo-nate Polypropyl-ene Silicone	29 in. x 25 in. x 21 in..	0.0025 in.	± 0.002 in
Selective Laser Sintering	Nylons Polypropy-lene TPU	19 in. x 19 in. x 17 in.	0.030 in.	± 0.010 in
Multi Jet Fusion	Nylons	11.1 in. x 14.9 in. x 14.9 in.	0.020 in.	± 10.012 in
PolyJet	Elastomer (30A to 95A)	19.3 in. x 15.4 in. x 7.9 in.	0.012 in.	± 0.005 in
Carbon DLS	ABS Polypropyl-ene	7.4 in. x 4.6 in. x 12.8 in.	0.012 in	± 0.010 in

For the different printing technologies, there are limitations around materials available, maximum part size, minimum feature size and tolerances. (Source: Protolabs)

6. Designing Elastomeric Parts for Overmolding

Overmolding elastomers is tricky when it comes to 3D printing. One process, PolyJet, can use a special "sprayable" liquid photopolymer that allows you to adjust hardness as the part is built. That's helpful if your aim is to prototype parts that will at some point be overmolded — such as a soft, grippable handle for a power tool or a weatherproof, gasketed cover for a scientific instrument housing.

If you want to validate an overmold design, PolyJet is probably a good place to start. However, you need to ensure that your design is suitable for molding. Some designers get married to particular geometries, only to find out too late that the part can't be manufactured cost-effectively in large quantities.

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FRX Innovations Invents New Polycarbonate Formulations Free of Forever Chemicals

FRX Innovations (TSXV:FRXI) (FSE:W2A.F) (OTC:FRXIF) ("FRX" or the "Company"), is pleased to announce that it has filed a new patent for what the Company believes and customer feedback supports will be a breakthrough in key application areas specifically meeting or exceeding the rigid fire retardant requirements for polycarbonate (PC) plastics and its alloys. This invention is free of the increasingly banned "forever" PFAS chemicals and allows for completely PFAS-free formulations in polycarbonate, including elimination of the well-known anti-drip agent, PTFE.

This is an enormous breakthrough as flame retardant PC and its alloys are used in a wide range of everyday products from consumer electronics to electric vehicles, to home appliances as well as many industrial applications. Flame retardant PC is forecasted to grow at a CAGR of 5.5% according to Industry Growth Insights, and it forms part of the $1.5B PC sheet market as estimated by Allied Market Research in June 2022.

PLASTIC MACHINERY

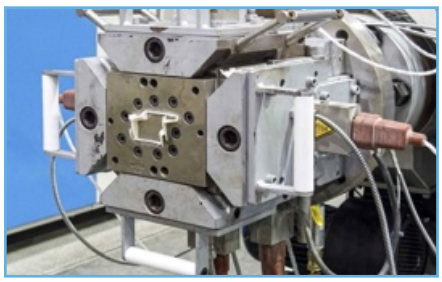
Multi - Agitator Mixing System

Operators can monitor key parameters in real - time through a 7 - in. color touch screen interface. Ross has engineered a customized VM - 450 - gal VersaMix that features three independently - driven agitators, including a two - wing center - mounted agitator with contoured bottom and Teflon scrapers to efficiently motivate viscous product throughout the mixing zone, a long helical flight agitator to produce better top - to - bottom mixing and a dual propeller agitator for low shear, high flow mixing. The tank of the VersaMix is fabricated from durable 304 stainless steel, designed for vacuum operation and internal pressures of up to 50 psi. For efficient discharge, a two - way, flush tank ball valve has been integrated, while a 14 - in. manway provides access for ingredient additions and cleaning operations.

Through a 7 - in. color touch screen interface, operators can monitor key parameters in real - time. The latest line of dual - shaft mixers from Ross Mixers are said to be robust and versatile systems that are powerful enough to batch dispersions, suspensions, and emulsions with viscosities up to several hundred thousand centipoise. The custom - built ROSS FDA - 3500 (photo) has a maximum working capacity of 3500 gal, a two - zone stainless steel dimpled jacket for heating / cooling, a 4 - in. pneumatic discharge valve and an explosion-proof load cell system rated for up to 20,000 lb.

This multi - agitator system is equipped with independently controlled drives and is highly efficient at producing good turnover and imparting shear to a viscous batch. Powered by a 300 - hp TEFC inverter duty motor, the high - speed disperser runs at tip speeds up to 5000 ft/min., inducing high shear forces while the 60 - hp three - wing helical anchor agitator feeds product towards the disperser blade and ensures that the mixture is constantly in motion. Teflon scrapers on the anchor wipe materials from the vessel wall, enhancing heat transfer from the jacket.

Is your Die Flow Changing Despite Following all the Correct Formulas?



Let's troubleshoot and look at the steps which may be causing the flow shift.

- **Pressure :** Back pressure is usually monitored and recorded in most extrusion shops but is seldom manipulated to optimize the process. When a new tool is tuned, the pressure is recorded as a standard and not questioned if it is correct. Many articles have been written on the how low head pressure can cause poor screw performance in a single - screw extruder. What we are looking for in pressure as it pertains to flow shift in the die is consistency. A consistent pressure should always be presented to the die for stability.
- **Melt Temperature :** Much like pressure, the melt temperature should always be presented to the die in a consistent manner to ensure stability.

- **Die Land** : If the die - land ratio is not sufficient, the lowered residence time (along with a lack of back pressure) will create flow shift and instabilities. Many shops tend to start out light on the land ratio and do not have sufficient land for stability after the land is reduced in the development process. Be steel safe and err on the extra landside. As an added benefit, land reduces the swell of the material as it exits the die. Most materials call for a 15:1 land ratio or greater.

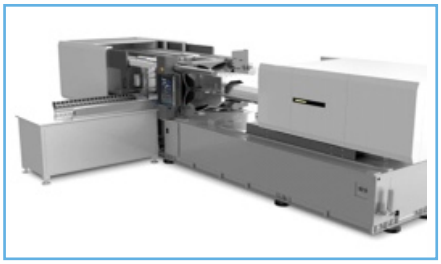
- **Heater Bands :** In a past article, I wrote about the five heater band principles being one of the most overlooked variables of the extrusion process. Let's assume you have read the article and corrected any deficient principles of the five and heat to the die is correct and consistent. At this point, you may want to go back and read that article and do a double check on the heater bands.

Ok, so what if the pressure, melt temperature, die land and heater bands all check out, but the dreaded flow shift happens anyway. There is one more thing to do, which many times will stop flow shift : Lubricate the tooling.

Lubrication Can Improve Drag Flow

The cavity of a streamline plate does not fill equally because the channel lengths are different, with varying lengths of drag flow. The bigger the tool, the larger the cavity to fill and the greater the potential for problems. Lubricate all components of the tooling while hung on the extruder, before starting up. The initial pressure will be reduced but will increase and reach a stabilization point. Many times, the improved drag flow will eliminate the flow shift issue.

Double Production and Stay Competitive in Injection Molding



The Shuttle Mold system enables users to inject parts in two molds with a single injector, turning cooling time for one part into productive time for another. The Shuttle Mold System from Canon Virginia allows a molder to turn cooling time into productive time. The system enables the injector to make parts in a second mold while the part in the first mold cools.

Every injection molding machine knows cooling time is lost productivity. They spend hours of engineering time and thousands of dollars just to shave a few seconds off a cycle. Unfortunately, improvements to cooling time necessarily bottom out. There is simply no way around the fact that plastic must cool down before it can come out of the mold, and you can only reduce cooling time so much before you run into issues affecting part dimensions and physical properties.

Faced with this reality, one company decided that instead of making cooling time shorter, it would turn this lost time into production time. To do this, Canon Virginia uses a shuttle system to switch between two molds using a single injection molding machine. Because they can simultaneously mold two parts at the same time, total part cycle time can be dramatically reduced which the available capacity of the molding machine goes up significantly. Here's how they do it.

Two Molds are Better than One

The Shuttle Mold System from Canon Virginia relies on a simple premise : Rather than waiting for the part to cool before beginning a new cycle, the system runs two separate molds in a single press simultaneously. The process begins with the system injecting plastic into the first mold, which the system then unclamps and moves the mold out of position as it shuttles the second mold into place. As the part in the first mold cools outside the machine, the system clamps the second mold into place and injects the plastic into it. Finally, the system unclamps and moves the second mold out of position, bringing the first mold back into place where it can eject its part and restart the cycle.

According to Canon Virginia Director of Business Development Wayne Daniel, this process came about after Canon started changing how they thought of cooling time. While common practice treats any time spent cooling as time wasted, the company recognized that there were diminishing returns with

that approach. “It's a known fact that molded parts have to have cooling time, whether it's short or long,” he says. “Instead of reducing it, we asked ourselves how we can utilize it.”

Here we can see the Shuttle Mold in action. After the first part is injected, the mold moves out of the way and the machine moves on to inject in a second mold.

Depending on the process, the Shuttle Mold can improve efficiency as much as 200%. “It's not a fit for every process,” Daniel says, “as it relies on a cooling time long enough to accommodate an additional injection.” Smaller injection molding machines and parts with short cooling times simply do not see as much benefit as parts more suited to the process. “Once you get to 30 - second cycle times, the Shuttle Mold can start showing productivity improvements over a single - mold process,” says Daniel. “Once we can effectively double the production over a single mold, we can hit 200% efficiency.”

Additionally, the cost savings the Shuttle Mold System provides are exceptional. Compared to the cost of buying two separate machines, including dryers and other auxiliary equipment, purchasing a single machine with the capacity of two provides excellent savings. “You can double your production speed for one part,” Daniel says, “or you can produce two different parts with a single machine. Both options save you a lot of money in the long run.”

The Nuts and Bolts

While the concept is simple, the engineering that went into making the Shuttle Mold is advanced. “It requires integration with the machine maker, including both the physical shuttle and the software,” Daniel says. “However, it can work with any molding machine that can be easily upgraded.”

When cooling times are around 30 seconds, the Shuttle Mold can start showing productivity improvements over a single - mold process. Under the right conditions, Canon Virginia can effectively double the production rate, as this chart shows.

While the tooling is quite like a standard injection mold, the mold base needs to meet certain conditions to work with the rollers that shuttle the molds into position. “This is not a problem for new molds,” Daniel says, “as this can be incorporated in the tool design. It does mean reworking existing molds, however.” Other modifications are relatively minor such as relocating existing water and electrical connections.

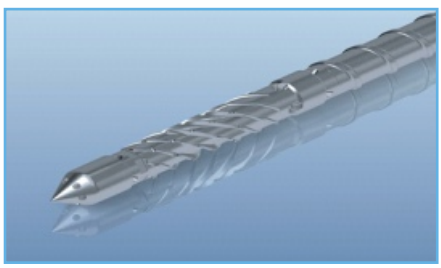
As you can see here, the two molds used in the Shuttle Mold System do not have to be identical. You can have two molds making the same part, or you can have completely separate parts in production.

According to Daniel, injection molding machines are not limited to always using the Shuttle Mold system on machines equipped with it. If, for example, a company needs to run other molds on the machine and does not wish to use the shuttle function, it is perfectly capable of operating as a standard single - mold machine. “It does not hold your machine captive,” he says.

Canon Virginia is actively involved in supporting its customers, working with them to develop processes and providing support. “We developed this system to improve the cost and efficiency of producing inkjet printer parts in - house,” Daniel says. “It started out with an end - user focus because we are end users.”

Since the first public demonstration at the 2018 National Plastics Expo, Canon Virginia has seen interest in its system grow. “At first, we sometimes see resistance to the idea, as it runs counter to the philosophy most molders work by,” Daniel says. “But shaving a few seconds off of cooling, or even cutting cooling time in half just isn't as efficient as working straight through the cooling cycle.”

Double Production and Stay Competitive in Injection Molding



Lightweight solutions with a smaller CO2 footprint

According to KraussMaffei, physical foaming of thermoplastics (MuCell) saves money, energy and resources. After intensive development work, KraussMaffei is presenting the new HPS - Physical Foaming universal screw for MuCell applications.

KraussMaffei says that In the effort to conserve resources, MuCell is being used more and more frequently and is a strong growth market. By adding a physical blowing agent to the thermoplastic (usually nitrogen), it is possible to save significant material weight compared to compactly manufactured components. In addition, longer flow paths are possible for thin - walled components, and foaming results in low - warpage components.

Universal screw with versatile applications

The materials used for MuCell are diverse and often contain different proportions of fibres and fillers. In the HPS - Physical Foaming, KraussMaffei has responded to this by developing a screw that can be used universally and according to the company has a 30 percent higher plasticizing capacity.

For this purpose, all screw types available on the market were compared in extensive laboratory tests. A modular concept made it possible to combine the individual components by means of bolting so that a new screw did not have to be made each time. The focus was on the mixing and gas supply area, the centre backflow barrier and the three - zone area.

More plasticizing performance with less wear at the same time

KraussMaffei says that the three - zone area was able to be enlarged without loss of quality at the expense of the former and is now 17 times the diameter (previously 15D; mixing and gas supply area now 4D). This both increased the plasticizing performance and had a favourable effect on the wear behaviour. Up to now, larger screws (with a correspondingly higher investment) were usually used than the component weight would normally dictate in order to ensure complete homogenization of the melt before injecting the gas.

The middle non - return valve (M-RSP) closes at the end of the metering process, thereby separating the mixing and gas supply area from the three - zone section and preventing the melt from flowing back. According to the company, this is the only way to keep the critical pressure above 33.9 bar and thus prevent foaming in the plasticizing unit. Another task of the M - RSP is to ensure a constant shot weight. The developers' analysis showed that the most effective design of the M - RSP has a ball check valve. Here, too, the various materials used played a major role.

Trials with different fillers

The KraussMaffei team investigated the previously existing and the newly developed screw using PP with different flow indices (MFI 11 and MFI 44), with mineral filling, glass fibre content of 20 and 30 (LGF) percent, and with ABS and PA6 GF 30. According to Krauss Maffei, the plasticizing performance changes depending on the compound selected and the parameters set, such as dynamic pressure.

Since KraussMaffei's MuCell customers have a wide variety of applications worldwide, the universal screw had to reflect this diversity. The three - zone section was therefore designed with one thread (for PA6 Gf30, two threads would be even better), and the M - RSP with ball check (for high - viscosity materials, a helical shear section is also possible).

The in - depth research effort yielded additional benefits beyond HPS - Physical Foaming. KraussMaffei says it now has a knowledge toolbox that makes it possible to develop screws specially adapted to a material for customers who manufacture corresponding products constantly over a long period of time, for example. Here, too, the modular concept is helpful for quick tests.

Miniature Melt Pressure Sensor Takes Measurements Directly in the Nozzle

Kistler says the ultra - compact Type 4004A piezoresistive pressure and temperature sensor can be applied in hot runners and 3D printing applications.

Kistler has introduced the new Type 4004A piezoresistive melt pressure sensor, featuring a front diameter of 3 mm, which allows it to operate directly in injection nozzles and small extruders. In these spaces, it can measure both pressure and temperature in direct

contact with the plastic melt, with potential applications in hot runner systems and additive manufacturing.

With an operating and measurement range of up to 350°C, the 4004A melt pressure sensor can be used directly in the hot runner to deliver precise measurements of pressure and temperature in injection nozzles and extruders.

For the two different processes, the 4004A features two separately calibrated pressure ranges, going up to 2500 bar (36,000 psi) for hot runners and up to 1000 bar (14,500 psi) for additive manufacturing. Changes in the pressure signal could detect debris in small nozzles, wear in the nozzle or melt backflow.

Access to key parameters comes via TEDS (Transducer Electronic Data Sheet), and since the sensor's diaphragm is made of hardened steel with an Ip65 degree of protection, the 4004A can be used for applications involving fiber - reinforced plastics. It can also be operated in medical and food packaging sectors since no oil or mercury are used to transmit the signals.

The temperature - compensated pressure signal can be accessed via the analog output or the sensor's RS232 interface. This allows it to connect to Kistler's ComoNeo process monitoring system.

The new 4004A miniature melt pressure sensor from Kistler allows for measuring pressure and temperature directly in the hot runner at temperatures up to 350°C.

An Industry 4.0 Solution for Plastics Manufacturers

Abstract

This study used bibliometric analysis to investigate trends and knowledge in Industry 4.0 research. Overall Industry 4.0 research was compared with that focused on the plastics industry by using data collected from current literature in the field. The analysis was conducted using the Bibliometrix R - tool and VOSviewer software. The results indicated that : (1) "Internet of Things" was the most commonly used keyword; (2) Industry 4.0 research can be divided into clusters; (3) countries such as China and the USA dominate Industry 4.0 research; (4) Industry 4.0 research in the plastics industry is in its initial stages but is growing; and (5) there is a large difference between overall research and that in the plastics industry. A discussion of these results, including limitations and recommendations for future research, is provided.

Introduction

Industry 4.0 was introduced by the German Federal Government to refer to the current trend of establishing intelligent products and production processes and is commonly referred to as the fourth Industrial Revolution, smart factory, intelligent factory, Internet of Things (IoT), and cyber physical system (CPS) [1]. The transition to Industry 4.0 is a priority for many practitioners and researchers [2,3] and is reshaping industries by promoting the integration of industrial and systems information with communication technologies [4,5]. Several factors indicate the importance of Industry 4.0, particularly its potential to address economic opportunities [2,4], social issues [3, 6, 7, 8], and ecological issues [9]. From an economic viewpoint, several opportunities offered by the implementation of Industry 4.0 have been identified, such as enhanced value creation and competitiveness [10], greater flexibility and efficiency of production [11], faster reaction to critical events [12], and reduction of logistics costs [13]. From an ecological viewpoint, reductions in greenhouse gas emissions [14] and waste [15] have been demonstrated by organizations that have implemented Industry 4.0.

The plastics industry, which includes composites, has been growing worldwide for several years. According to a study by Grand View Research, the global market for the industry could reach $654.38 billion in 2020. This global growth has been beneficial to Canada, since this industry grew by 2.2% between 2012 and 2017 [16], although such growth was low compared to other countries, such as France, where the industry showed annual growth of 4.3% in recent years. The growth has not been equally profitable for all organizations. For example, a study conducted in 2019 on the performance of one of the largest plastics manufacturing groups in Canada found that only 50% of plastic companies experienced growth during the previous year. One of the most cited reasons by managers for low growth was lack of Industry 4.0

implementation. More specifically, there is a great lack of knowledge about Industry 4.0 in the plastics industry. To understand whether this lack of knowledge is also present in research, we assessed the state of overall Industry 4.0 research and compared it with similar research in the plastics industry.

According to Muhuri et al. [17], bibliometric analysis is "the research area which helps to analyze current trends in the literature regarding a particular area and provides guidelines and motivations for future research work." Various bibliometric analyses are used to assess the state of knowledge and development in a field by analyzing the relevant literature. For example, a recent bibliometric analysis of Industry 4.0 was conducted by Muhuri et al. [17], who retrieved only the term Industry 4.0 to create a bibliography. However, Industry 4.0 is also referred to by other terms, such as smart factory, Internet of Things, and cyber physical system. Muhuri et al. [17] also analyzed two databases separately (Web of Science (WOS) and Scopus), although several scholars [18, 19] argue that these two databases correlate highly, and the duplicate publications can influence the results.

To address these gaps in the knowledge, this study conducted a bibliometric analysis of Industry 4.0 research by searching the databases using multiple, similar terms for Industry 4.0. Using Endnote software and the R package, we combined publications from WOS and Scopus to eliminate duplications. We also conducted a comparison of overall Industry 4.0 research (hereafter, WI) and Industry 4.0 applied to the plastics industry (hereafter, PI). This comparison is important for two reasons. First, it explores whether research in one industry is underdeveloped in comparison to all industries; and second, it assesses whether the plastics industry follows similar thematic trends and challenges to those in other industries.

This study makes three major contributions. First, although many bibliometric analyses offer an overview of Industry 4.0, none use a bibliometric approach to study comparative trends between WI and specific industry. Second, the results are expected to provide researchers and managers in the plastics industry with an extensive view of the trends in PI in comparison to those in WI. Third, we provide detailed information regarding PI research, such as the most influential authors and papers.

Industry 4.0

According to Xu et al. [20], before being introduced in 2013 by the German government, Industrie 4.0 (or Industry 4.0 in English) was presented at the Hannover Fair in 2011. Lu [21] argues that Industry 4.0 is defined differently depending on the research category. For example, Hermann et al. [22] define Industry 4.0 as a group term for concepts of value chain organization and technologies, such as CPS and the IoT. Ghobakhloo [23] argues that the core of Industry 4.0 is the fusion of physical.

Bibliometric methods

Pritchard [36] defines bibliometrics as "the application of mathematical and statistical methods to books and other media of communication," which a definition that has been expanded in different ways. According to several authors [e.g., 18], bibliometric analysis can be defined as a method for analyzing the research structure and tendencies of a topic. According to Ellegaard and Wallin [37], it can be used to identify aspects of science that receive the most contributions from authors,

Results

After removing duplicates in the two databases, the identification step generated 51,508 studies on WI and 314 on PI. After retaining only journal articles and articles from conference proceedings, we were left with 26,531 studies on WI and 153 on PI. We excluded 141 publications on WI and 15 on PI that did not have an ISSN, resulting in a final database with 26,382 documents related to WI, which included only 138 papers associated with PI. Table 1 summarizes the major statistics for the

Discussion

The first objective of this study was to provide an overview of the state of knowledge and the trajectories of research regarding Industry 4.0 by: (1) using multiple terms for Industry 4.0 to retrieve publications from WOS and Scopus; and (2) analyzing the obtained results by merging those databases. The second and primary

objective was to compare the state of the knowledge in PI with that of WI. To achieve these objectives, we used two types of bibliometric methods: evaluative techniques and

Conclusions and perspectives

The results of our bibliometric analysis based on a merged database and use of multiple terms used to retrieve publications related to Industry 4.0 differed from those of Muhuri et al. The biggest difference was related to the level of analysis, such as the analysis of the most productive authors and countries. Whereas 26,382 publications in WI research were retrieved from the merged database, only 138 publications were retrieved for PI. The most productive author in PI had only 5 papers, while

Credit authorship contribution statement

Saïd Echchakoui : Data curation, Methodology, Software, Formal analysis, Writing - original draft. Noureddine Barka: Supervision, Writing - review & editing.

Declaration of Competing Interest

None

Multi - Shaft Mixers for Medium - to High Viscosity Applications

VersaMix Multi - Shaft Mixers from Ross are reportedly ideal for processing medium - to high - viscosity applications up to several hundred thousand centipoise. Pictured are two 3000 - gal VersaMix Model VM-3000 equipped with a custom combination of three agitators each driven by a 60 HP TEFC inverter - duty motor?

The three - wing anchor and two screw augers are all independently controlled with variable speeds, working together to ensure efficient batch turnover at every ingredient addition and mixing stage.

These vacuum - rated VMC-3000's are operated from an independent 15 - in. NEMA 4X touchscreen control panel. The mixers also feature stainless steel type 304 dimpled, dual - zone jackets designed for 100 psig at 200oF. VersaMix models range from laboratory to large - scale capacities up to 4000 gal.

Change Over High - Output PET Blow / Fill / Cap Lines in Just One Week

Sidel delivered seven new PET bottle formats across two integrated water and soft - drink bottling lines within a week apiece.

MenaBev, based in Jeddah, Saudi Arabia, is said to be the leading bottler of water and soft drinks in the Middle East and North Africa. Its 300,000 m2 Mega plant near Jeddah is one of the largest and most automated PepsiCo bottling plants worldwide. It has three PET lines from Sidel– two for carbonated soft drinks and one for water – plus three can and glass lines.

Late last year, MenaBev needed to retool two Sidel Combi integrated PET blowing / filling / capping lines to produce, on one line, three new - look Aquafina water formats and, on the other line, four new “Carolina” bottle formats for PepsiCola. The Aquafina line involved new 330 - ml, 500 - ml and 1.5 - liter bottles. For the 330 - ml bottle, Sidel delivered a new design with 10% lighter weight.

Both Sidel Combi lines incorporate Universal stretch - blow molders, the one on the Aquafina line with 30 stations and the one on the Pepsi line with 24 stations. Each line was adapted to the new formats in one week apiece. What's more, Sidel's engineers were able to increase the Aquafina line's output up to 60,000 bph from 54,000 bph previously. The Carolina Pepsi line maintained its optimized speed of 48,000 bph.

CIRCULAR ECONOMY/ BIO-PLASTICS/ RECYCLING

TotalEnergies and COLINES® Partner to Create Unlaminated Recyclable Packaging Contributing to Resource Efficiency Utilization

TotalEnergies and COLINES® announce the successful proof of concept of an Unlaminated Recyclable Stand - Up Pouch suitable for food - contact applications.

Currently the market reference is composed of a multimaterial film, resulting to non-recyclable packaging. The partners have developed a full PE recyclable Unlaminated Stand-Up Pouch, allowing to decrease the packaging thickness. The Machine Direction Orientation (MDO) film has been produced on the COLINES® cast line Polycast as well as the MDO line, allowing asymmetrical structure (low density sealing layer on one side, high density stiff layer on the other side). The MDO-PE film formulation is composed of TotalEnergies Supertough® and unique Lumicene® high density PE, offering a vast thickness range of solutions fitting customer's needs.

The game changer film has been printed by Cirepa, a printing company for flexible packaging, and then transformed into a Stand-Up Pouch by Dry-Top, a packaging company.

"This collaboration is in line with the recent developments to provide packaging solutions that are fully mechanically recyclable, with the end goal to bring more qualitative feedstock on the market. This latter could be used as feedstock for the recycling industry and eventually end up as RE:use polymers, part of the RE:clic range supporting our ambition of producing 30% circular polymers by 2030. This development was made possible by our broad Lumicene® and Supertough® product range bringing outstanding processability as well as excellent mechanical and optical properties." said **Olivier Greiner, Vice President, Polymers Europe & Orient at TotalEnergies.**

"We are proud to be part of this very important project, made possible also by the proprietary COLINES® technology in the field of MDO, as well as by innovative and patented solutions for the production of MDO-PE films with cast technology. Our portfolio includes various solutions for the production of "green" films, with a high recycled content or suitable for complete recycling, in order to satisfy practically all market requests." Said **Nicola Lombardini, R&D Manager of Colines.**

UN Group Completes 2nd Meeting Aimed at Developing Agreement on Plastic Pollution

Intergovernmental Negotiating Committee prioritized consensus building and reviewed possible content of binding instrument.

Delegations from 169 nations gathered in Paris May 29-June 2 for the second session of the UN's Intergovernmental Negotiating Committee, with the purpose of developing a legally binding treaty to address plastic pollution. The first of the five planned sessions took place last November in Uruguay.

The diverse group encountered challenges in achieving consensus on procedural issues, delaying

negotiations on issues related to plastic pollution for days. Finally, participants split into two contact groups for discussion of the possible approaches to protecting human health and the environment from plastic pollution.

Contact Group 1 discussed possible core obligations of the agreement, identified by the first INC meeting. Facilitators reported broad support for obligations to protect human health and reduce leakage of microplastics into the environment. Members called for intersessional work to define categorizations like “problematic”, “avoidable”, and “of concern”.

Simultaneously, Contact Group 2 discussed possible approaches to implementation and debated their merits. Facilitators reported convergence on the use of national action plans, the need fo r a scientific and technical body to ensure an evidence basis for the instrument, and supporting capacity building with financial assistance and technology transfer.

Intersessional work will be conducted ahead of November's session in Nairobi, including a zero draft of the agreement to be written by the INC chair. The 4th and 5th sessions will be held in Canada and South Korea, respectively. The UN has targeted the end of 2024 for completing negotiations.

Global Chemical Companies Announce Hub for Plastic Waste Processing Research

Members of the Low Carbon Emitting Technologies initiative signed an agreement with TNO to establish R&D Hub.

Seven members of the Low Carbon Emissions Technology initiative (LCET), BASF, Covestro, Dow, Mitsubishi Chemical, SABIC, Solvay and Lyondell Basell, signed an agreement with the independent research organization TNO, establishing a research hub in the Netherlands.

Activities at the hub, hosted by TNO, will focus on the development of sustainable, low carbon reprocessing of plastic waste. According to SABIC, the first projects will focus on improving plastic waste sorting with new ideas for detection of different types of polymers and contaminants in material streams, and for improving the separation of plastics from fibers, fillers and other inorganics.

Participating companies are hopeful that the research can help remove some of the technological obstacles to improving access to recycled materials, by improving quality, reducing contamination, and improving supply consistency.

The establishment of the research hub is the first project to come from the LCET initiative, established in 2019 to accelerate the development and scaling of low-carbon emitting technologies for chemical production. The initiative has set a target of 2050 for reaching carbon neutrality.

Evolving Opportunities for Ambitious Plastics Recycler

St. Joseph Plastics grew from a simple grinding operation and now pursues growing markets in recycled PP, food-grade recycled materials, and customized post-industrial and post - consumer compounds.

Consumer goods brands have set ambitious targets for incorporating recycled plastics into their products, in response to consumer preferences and regulatory mandates. If the targets are to be met in the near future, the industry will rely upon mechanical recyclers to reprocess a range of materials reclaimed from various points in the value chain into a variety of resin grades and compositions for a multitude of applications. An example is St. Joseph Plastics of St. Joseph, Mo., which has been building up this proficiency since the 1980s.

St. Joseph Plastics was founded in 1987 by Jerry Thacker, an injection molding machine operator who found a market for plastic scrap that was being discarded by his employer. By 1990, the business had moved from a garage to a 5-acre facility and grown to include two grinders and five full - time employee. Despite the success of the young venture, Thacker decided to sell. The new owners took over a business with an expanding customer base but plenty of space for growth, both literally and in terms of sophistication.

“We really wanted to make the processes better, hire good people, and differentiate through

quality," says Rob Starr, St. Joseph's current owner and president. "At the time we were maybe a 'C' level supplier, and our goal was to work our way up to 'A'.

We want to be our customers' and suppliers' Number 1, so that when market conditions are tough and the other guys are being knocked out, we're the ones to supply that last piece of business." With a focus on building relationships and producing quality regrind, St. Joseph Plastics continued to expand throughout the 1990s and 2000s, engaging new customers and finding new sources of scrap .

Fundamentally, the focus of the business remained the same: buying, grinding and selling. Then, in 2009, the company decided to expand its offerings to include pellets and purchased its first extruder.

From 2010 to 2012, further investments in a lab and additional extruders prepared St. Joseph Plastics for entry into the compounding business. "You really can't do anything until you have a good lab, and it took some time to build that up. We then became a compounder and started to offer more resins to more customers, " says Starr.

Recycled Materials Lost a Major Outlet

Around that same time, material recovery facilities (MRFs) had started to collect and provide the first bales of post-consumer PP. St. Joseph began tests with the material and soon developed and successfully marketed pellets of that versatile resin. For years, however, many MRFs did not collect PP or did not separate resin codes 3 to 7 (that is, a mix of plastic waste from which PET and HDPE have been removed). Around 2018 to 2020 the economics began to change.

China launched Operation National Sword in 2017, a program that implemented much more stringent review of that country's imports of plastic waste. Abruptly, the global market for reclaimed plastic lost its number-one buyer. The West suddenly found itself without a market for low-value material it was producing in large quantities.

China's new waste import restrictions affected prices across all reclaimed plastics, but particularly unsorted and contaminated mixed plastic bales. In the aftermath, more MRFs are looking to increase value by separating out higher-value products from their mixed-plastic bales, including PP.

PP bales from recovery facilities are one important feedstock for recycling operations at St. Joseph Plastics. As more MRFs add PP to their accepted items, and modernize to improve their sorting capability, availability and quality of these bales is likely to improve.

While post - consumer recycling is an important and growing part of St. Joseph Plastics' business, the majority of the material it processes is post-industrial PP and PE from molding operations. "It's just as important as post-consumer," says Starr. "Most molders have a scrap rate around 3-5%, and that doesn't include obsoletes. There's a lot of post-industrial material out there, and it all needs to be recycled."

Integrated Plastic Recycling

Today, St. Joseph Plastics is a sophisticated, full-service recycler with over 100 employees. Operations have expanded to three processing facilities, two in St. Joseph itself and one in the city of Sedalia, Mo., two hours to the east. Sedalia is the starting point for bales of post-consumer material. Bales are broken, material is fed through a trommel to remove contamination, then washed, aspirated, sorted, and dried before transport to St. Joseph for further processing.

"Most molders have a scrap rate around 3-5%. There's a lot of post - industrial material out there, and it all needs to be recycled."

The grinding operation now boasts eight lines and has moved to the company's Easton Road facility, just a few miles from the original location. These lines are primarily fed scrap material purchased or tolled from a wide variety of injection molding operations. These come in all shapes, sizes and colors, ranging from purgings or simple parts to completed assemblies, which may require removal of contaminating materials such as metal. Molding rejects and other scrap are shredded and ground, then shipped to customers or passed to the compounding facility for further processing.

The original St. Joseph Plastics site now houses testing, compounding, sorting, and blending operations. Six extrusion lines melt, purify, and pelletize granules and other feed materials.

Silos with integrated blending provide homogeneity in addition to stabilization. “It's really essential to have good blending capability,” says Starr. “Our goal is that the whole truckload be uniform, so when the molder gets the product, they set their machines once and run for 42,000 lb.”

Material Testing is Crucial

At any moment, post-consumer and post-industrial waste from a variety of suppliers is making its way through this manifold of processes, on its way to becoming a variety of blends bound for St. Joseph's customers. Material traceability could not be more critical. “The challenge is getting consistency in our resins,” says Starr. “Each supplier may use several different resins themselves, so we have hundreds of different grades coming in here, and we have to figure out how that affects our end product”.

The analysis lab is critical to establishing and tracking the key characteristics of the recycled materials so that each lot can be managed and tracked, always with an eye to the needs of the customer for that product.

“Brand names are coming to the molders and saying, 'You need to get recycled resin into our products, so we can have that benefit when we market them'.”

Materials are tested when received, throughout processing, and before shipping. The lab includes instrument for measuring melt-flow index, Izod and Gardner impact resistance, ash content, flexural and tensile properties, and more. The lab also has a small extruder for trials and other needs as they arise. The data builds St. Joseph's knowledge of the interaction between processing steps and feedstock material properties, which guides production adjustments and blending.

The objective is to provide the customer, who may be reluctant to try out a recycled resin, with a product they can drop right into their process with minimal adjustment.

This is especially important for molders who may be new to recycled resins. Sometimes, spec agreements with manufacturers may be an obstacle. These agreements are meant to ensure consistent quality, but can end up restricting the resins a molder can use.

“We suggest people to talk to their customers about opening that up,” says Ron Moore, product v.p. at St. Joseph Plastics. “Now it's starting to work the other way: Brand names are coming to the molders and saying, 'You need to get recycled resin into our products, so we can have that benefit when we market them'.”

St. Joseph Plastics offers a variety of off-the-shelf resins for downstream processors, both in flake and pellet form. Offerings include 13 GreenCircle Certified resins. GreenCircle is a third-party certifier of post-consumer recycled resins, endorsed by the Association of Plastics Recyclers.

Knowledge of material properties and how they are changed by their processing steps has allowed St. Joseph not only to create a variety of blends for the market, but also to customize product for individual customers.
“Sometimes a customer may call us and say they need a certain resin specification, and we will design and produce a custom resin for them,” says Leighton DeGarmo, business development manager.

Future Directions in Recycled Resins

Converters can expect to see the expansion of St. Joseph's product portfolio continue, as the company seeks to leverage its expertise in material management, compounding, and blending to offer higher value, more complex resins.

Recently, St. Joseph Plastics received a "letter of no objection" from the FDA, concerning the use of post-consumer PP for food-grade applications. This means the company has demonstrated it has the correct quality controls in place to begin selling recycled plastic for use in food packaging, a high - value and desirable market for plastic recyclers and packaging converters.

“We are getting more and more into the development of resins.” says Starr. “We have experience with a lot of different materials, and we know what it takes. That has given us the confidence to get into more complex formulations.”

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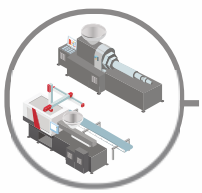

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