## MONO-MATERIAL PACKAGING

New guidelines, current scenario and key players in the flexible packaging industry



PRESCOUTER 2022

## Mono-material packaging will dominate the flexible packaging market by 2030.

'Mono-material packaging' has become a buzzword in the packaging industry, particularly in the flexible packaging sector, and will play a significant role in supporting a circular economy across sectors.

The current flexible packaging sector depends on multi-material packaging, which is difficult to recycle. This is particularly true for multi-layer flexible packaging and films that have evolved to incorporate multiple materials to achieve the best properties. Such materials can be mechanically recycled, but given the different materials involved, the resulting material is of low quality. Hence, multi-materials are not recycled or could potentially be chemically recycled, which is a more complex and less desirable route from a sustainability point of view.

'Mono-material packaging can be designed to be fully recyclable as all layers are made of the same type of plastic, leading to cleaner recycling streams and contributing to the circular economy. For instance, there is potential to replace metalized flexible packaging, which contains an inseparable thin layer of aluminum, making it problematic in the recycling process.

This Intelligence Brief discusses the new guidelines, the potential market and forecast for mono-material packaging in the flexible packaging sector, the main challenges, and the promising developing areas. We also profile the key players that have adopted mono-material packaging in their product portfolio and showcase case studies.

# The need for "recyclable by design" packaging is leading to new guidelines and initiatives encouraging companies to gradually replace multi-material packaging.



#### CEFLEX

The Circular Economy for Flexible Packaging (CEFLEX) initiative has developed the D4ACE guidelines [1] in 2020 to reflect the current state of knowledge as to what design characteristics are desirable for recycling. The focus is to redesign the multi-material structures to mono-material where possible, knowing that multi-material flexible films are not recyclable at scale [2,3]. The materials that comply with this guideline should have an amount of PP or PE higher than 90%, a maximum percentage of coatings/ inks/ adhesive of 5% and must be compatible with current mechanical recycling.

- 1. https://guidelines.ceflex.eu/resources/
- 2. https://sustainablepackaging.org/circular-economy-flexible-packaging-ceflex/
- https://packagingeurope.com/ceflex-strongly-recommends-use-of-recyclablemono-materials-for-flexible-packaging/2759.article
- https://recvclass.eu/recvclability/design-for-recvcling-guidelines/
- 5. https://www.bopetfilmseurope.com/vita-nova/



#### RecyClass

RecyClass launched 'Design for Recycling Guidelines' to support the industry on how to improve the overall recyclability of plastic products. It offers 'work-in-progress' documents for PET bottles, PET trays, HDPE and PP containers & tubes, EPS containers, PE and PP films, PS colored containers, and HDPE & PP crates and pallets [4].



#### **BOPET Films Europe**

BOPET Films Europe established a consortium of industry players called Vita Nova to promote the use of mono-PET flexible packaging and achieve a circular economy [5].

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## The biggest growth opportunities for mono-material packaging are in personal care & cosmetics, and food pouches.



The market for flexible plastic packaging



Estimated CAGR **4.5%** globally





Estimates 70-80% of flexible packaging is reported as mono-material or a mix of PE/PP, technically considered as "recycling ready" and the remaining 20-30% consists of multi-material flexible packaging.



Highest growing region is Asia-Pacific

1. https://www.marketsandmarkets.com/Market-Reports/flexible-packaging-market-1271.html

https://sustainablepackaging.org/circular-economy-flexible-packaging-ceflex/

# In terms of ESG goals, companies who have adopted mono-material packaging report achieving a lower carbon footprint and less use of resources such as water.



Klöckner Pentaplast reported a lower carbon footprint of their PET mono-material packaging (56.5 CO<sub>2</sub>eq against industry average of 69.9).



Zotefoams reported 11 times less water used for production and global warming potential 50% lower than the overall for their PE mono-material packaging.

## Main materials reported

- ✓ Polyethylene (PE): Mono-oriented PE (MOPE), LDPE, LLDPE, HDPE, BOPE (biaxially oriented PE)
- Polypropylene (PP): CPP (cast polypropylene), OPP (oriented polypropylene), BOPP (biaxially oriented PP)
- ✓ Polyethylene terephthalate (PET): BOPET (biaxially oriented PET), rPET100

- ✓ Polyamide
- ✓ Polyvinyl chloride (PVC)
- ✓ Regenerated cellulose fibre (RCF)
- ✓ Bioplastic (e.g. PLA (polylactic acid))
- ✓ Paper

For mono-material packaging to fully replace multilayer packaging, several challenges still exist and are key focus areas for R&D teams.

#### 8 key challenges R&D is focusing on are:

- 1. Heat-sealability
- 2. Adhesion
- 3. Printability
- 4. Achieving high transparency
- 5. Surface enhancement
- 6. Food contact compliance
- 7. Increasing stiffness
- 8. Reduction of used material, not reducing productivity

Multilayer materials are often composed of three layers of materials with different properties.

Modifying the mono-material to have the required properties for each layer is the key challenge.

Sealing Layer — Barrier Layer — Printing Layer —



## The right solution must take into consideration pricing, functionality, recyclability, and ease of production.



## Here, we identify 12 commercially available solutions from 8 companies.



The solutions cover different types of mono-materials, particularly PE, PP, PET and polyamide, aiming to replace multi-material laminated packaging, vinyl-based materials, EVOH-based products, PVC-based materials, and other non-recyclable materials.

The main applications are in the **food packaging industry** (impermeable packaging for food/consumer goods, stand-up pouches or pouches for dry food and frozen food, barrier packaging, etc.) and in the **pharmaceutical industry** (pharmaceutical blister films, pouches, etc.).



**PreScouter** highlights the European presence, particularly the partnerships between **Klöckner Pentaplast** and **Huhtamaki** and between **Mondi** and **Unilever** and **Henkel**.

Other solutions were identified and could be potentially profiled in the continuation of this work:

- Polysack Flexible Packaging Ltd.
- Starlinger & Co. Gesellschaft m.b.H./ Viscotec
- Mitsui Chemicals Group
- Walki Plasbel
- Tyler Packaging
- Coexpan
- Knauf Industries
- Dow Chemical
- Braskem and Antilhas (PE monomaterial) South
  America
- Wista Packaging (PE monomaterial) South America

## Summary of technologies profiled



	# of employees	Headquarter	Technology name	Mono-material used	Material aiming to replace	End-use application	Partners
<b>بیتابک</b> مادا <i>له ف</i>	>32,000	Riyadh, Saudi Arabia	SABIC® LLDPE TF-BOPE	LLDPE	Multi-material laminates	Frozen food packaging, stand-up pouches, PVC- free cling film	Ticinoplast, Plastchim-T, Syntegon Technology
	>26,000	Vienna, Austria and Weybridge, UK	mono-PE	PE	Multi-material laminates	Stand-up pouches for home care products	Henkel
			mono-PP	PP	Multi-material laminates	Pouches for dry food	Unilever
Huhtamaki	>19,000	Espoo, Finland	Push Tab	PET	PVC-based /non-recyclable material	Pharmaceutical blister, Food packaging	Klöckner Pentaplast
BOREALIS Keep Discovering	6,900	Vienna, Austria	Mono-material flexible packaging	PE; PP	Non-recyclable materials	Stand-up pouches mostly for food	Borouge, Reifenhauser, GEA Food Solutions, W&H, AMAT, Alpine.
kp	>6,300	London, UK	Pentapharm® kpNext™ R1, RB5; SmartCycle®; kp Elite®	PET; PP/COC/PP	Vinyl-based materials	Pharmaceutical blister films, Consumer packaging, Food packaging	/
BOBST	5,800	Lausanne, Switzerland	oneBARRIER	PE	EVOH-based products	Impermeable packaging for food/consumer goods	Dow, Zermatt, and Sun Chemical
ZOTEFOAMS	>500	Croydon, UK	ReZone	HDPE	Composite carton packaging	Carton packaging	/
NUREL <b>F</b>	350	Zaragoza, Spain	Promyde, Recon Nylon	Polyamide	Multi-material layered materials/wasted plastic	Barrier packaging, clothing	/

## Technology Overview



## SABIC



Website: https://www.sabic.com/en Contact: Contact form HQ: Riyadh, Saudi Arabia Company size: >32,000 employees Founded: 1967

Main GMR focus: Tailor made material solutions for a variety of sectors

Key differentiator: Innovative ideas to help companies optimize their products, grow and meet their sustainability goals SABIC was founded in 1976 and is focused on customized materials solutions, serving a variety of markets, such as electronics, transportation, medical devices, construction, packaging, agriculture, and energy. It is located in Riyadh, Saudi Arabia, with over 32,000 employees in 50 countries. It generated sales of around \$47M (or billion) in 2021 [1][2][3].

**Company has the following expertises:** Polymers, chemicals, agri-nutrients, metals, specialties.



## TECHNICAL DATA SABIC® LLDPE TF-BOPE

SABIC provides mono web TF-BOPE (Tenter Frame Biaxially Oriented Polyethylene) film structure made of SABIC® LLDPE BX202. This innovative solution is a collaboration with film suppliers/extruders **Ticinoplast** and **Plastchim-T** and packaging machine manufacturer Syntegon Technology. This product was developed as part of the "Design for Recyclability" under TRUCIRCLE™ solution [4][5].

#### Mono-material: TF-BOPE

**Material it is aimed to replace:** Multi-material laminates. It can run in tenter frame machines traditionally used to make Biaxially Oriented Polypropylene (BOPP) film.

#### End-use application: Food and non-food packaging

**Advantages:** 100% recyclable in traditional mono-PE streams, higher throughput compared to traditional blown PE films, 20  $\mu$ m thickness (i.e. reduction of 35-50% of packaging material), low water consumption and CO<sub>2</sub> emissions during production, increased packaging speed (tested with Syntegon machinery).





Figure 1. LLDPE TF-BOPE packaging for frozen food [4].

## CASE STUDY Mono-PE stand-up pouch solution

SABIC provides mono-PE stand-up non-barrier pouches.

	Lamination film	20 µm	PE			
	Outer layer	17 µm	SUPEERTM7118NE + LDPE 2501NO			
	Core layer	35 µm	HDPEF 04660 + SUPEERTM7118NE			
	Sealing layer	8 µm	COHERETMS100 + LDPE 2501NO			
	COHERETMS100	Sealing properties				
	SUPEERTM7118NE	Mechanica	Mechanical properties			
Lamination film		Optics & good (reversed) printing Required for extra mechanical properties.				

SABIC claims that COHERE<sup>TM</sup> S100 can increase the  $\Delta T$  between the outer and sealing layers which is critical for sealing in mono PE-material PE solutions.





**Figure 2.** SABIC's stand-up PE pouch solution [8].



Figure 3. Lower sealing initiation temperature COHERE™ \$100 in sealing layer of a typical 3layers blown film [8].

## SABIC

SABIC has a very detailed structured sustainability project that involves partnerships, innovations, circular economy, key markets, and an outlook for the future. SABIC offers several other materials options within its TrueCycle, and has recently launched grades for automotive industry [6][7].

Other material options developed by SABIC [8]:

- mono-material film for the production of silage film
- to be used in large-scale agriculture
- PVC-free cling film



Figure 4. PVC-free cling film solution [8].

- 1. About
- 2. LinkedIn
- 3. Annual report
- 4. TF-BOPE mono PE press release
- 5. SABIC LLDPE BX202 grade TDS
- 6. Sustainability
- 7. TrueCycle
- 8. SABIC-Driving-D4R-in-flex-food-packaging

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SABIC

## Mondi



Website: www.mondigroup.com Contact: Contact form HQ: Vienna, Austria and Weybridge, UK Company size: >26,000 employees Founded: 1967

Main GMR focus: The company provides a variety of packaging and paper solutions worldwide.

**Key differentiator:** Sustainability and innovation driven, especially with their Eco Solutions.

Mondi was founded in 1967 and is focused on packaging and paper. It has offices in Vienna, Austria, and Weybridge, UK, and over 26,000 employees across 100 sites in 30 countries. It generated sales of over USD 8 billion in 2021 [1][2][3].

**Company provides the following products:** Eco solutions; corrugated and kraft solutions; flexible packaging, bags, and pouches; Barrier coatings; Office and professional printing papers; functional films; personal care components.



## TECHNICAL DATA Monofilm Rollstock

Mondi provides a variety of consumer packaging films made of mono PE. Their portfolio includes peelable films, high impact films for VFFS packaging lines, and easy open solutions [4]. This is part of their Eco Solutions portfolio [5].

Solution: mono PE packaging material for barrier applications

Mono-material: PE

Material it is aimed to replace: PET/PE laminates

End-use application: Food, pet care, and home and personal care applications.

**Advantages:** Lighter, stronger, and stiffer than usual PET/PE laminates, wide sealing window, straight and easy opening, zipper available, flexo and roto printing available in 10 colors, wide range of thickness and oxygen and mineral barrier levels, fully recyclable, compatible with existing packaging lines.

Disadvantages: Colors might be contaminants on the recycling process



Figure 1. BarrierPack stand-up pouch [4].

## CASE STUDY MONO-PE

Mondi has developed a recyclable mono-PE refill pouch that uses 70% less plastic for Henkel, following their sustainability goals. That is used along with Henkel's original rigid detergent bottles made of 100% recyclable PET [6].

#### Companies involved: Henkel

Location: Germany

**Objective:** Replacing rigid plastic bottles and providing easy-to-recycle solutions to the market

Methods: Employing mono-PE material

**Results:** Reduction of 70% in the plastic usage, certified by "Blauer Engel" in Germany.

**Figure 2.** Henkel Pril refill pouches made of Mondi mono PE material [<u>6</u>].





### CASE STUDY MONO-PP

Mondi has collaborated with Unilever to create a mono-PP solution for their dry soup powder in the Knorr line. That follows Unilever's commitment to have 100% of the plastic packaging as reusable, recyclable and compostable by 2025 [7][8].

Companies involved: Unilever, Jindal

Location: Turkey

Objective: Substitute usual multi-material laminate packaging

Methods: Mono-PP was used for the packaging

Recyclability: Certified as recyclable by the Institut cyclos HTP

**Compatibility with current production lines:** Does not impact the runability on the production machines

Oxygen and moisture barrier: Preserves the shelf-life of the food product



**Figure 3.** Knorr mono-PP packaging made in collaboration with Mondi [7].

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Mondi

mondi

## sustainability Mondi

Mondi has signed 'The New Plastics Economy Global Commitment', committing to 100% of plastic based packaging being reusable, recyclable or compostable and 25% being from recycled content by 2025 (food regulations permitting) [5].

They are also co-founders of the Circular Economy for Flexible Packaging (CEFLEX), along with other companies mentioned in this document - Henkel, Borealis, Dow, Huhtamaki, SunChemical, and kp [9].

Given their strong commitment with sustainability, they have been given many external recognition/certifications, such as AAA rating from MSCI [10].

Further partnership with Borealis, Henkel, and APK has also been announced in 2018 with the goal of improving the sustainability of plastic multi-layer flexible packaging [11].

About
 LinkedIn
 2021 Financial report
 4. BarrierPack
 ScoSolutions
 Case Study wi Henkel Press Release
 Case Study wi Unilever Press Release
 Case Study wi Unilever Mondi Press Release
 Case Study wi Unilever Mondi Press Release
 Case Study wi Unilever Mondi
 10.Sustainability at Mondi
 11.Other partnerships



## Huhtamaki



Website: www.huhtamaki.com Contact: E-mail HQ: Espoo, Finland Company size: >19,000 employees Founded: 1920

Main GMR focus: Sustainable packaging solutions for consumers around the world.

Key differentiator: Part of the UN Global Compact. It was awarded the EcoVadis Gold medal for performance in sustainability. Science-based targets established have been approved and validated by the Science Based Targets initiative. Huhtamaki was founded in 1920 and is focused on providing sustainable packaging and containers solutions for consumers world-wide. Its headquarter is located in Espoo, Finland, with over 19,000 employees across sites in 38 countries. It generated net sales of USD 3.79M in 2021 [1][2].

**Company offers products for the following segments:** To-go containers; retail and catering solutions; beverage and food packaging; personal and home care.



## TECHNICAL DATA Push Tab®

Huhtamaki provides Push Tab® product line with various flexible blister solutions. The subcategories available are: Push Tab® (highest barrier), Push Tab® eco (additional cost saving), Push Tab® clear (transparency and product visibility), Push Tab® loop (circular economy), Push Tab® blister lid (mono-PET blister lidding) [3].

Solution: Pharmaceutical and healthcare blister films

Mono-material: PET

Material it is aimed to replace: PVC-based and non-recyclable materials

End-use application: Pharma/OTC, food supplements, and confectionary

**Advantages:** PVC-free, unlimited forms & shapes, adaptable handling options, child resistant/senior friendly options, cost optimized tablet packaging

Disadvantages: Color may be a contamination when recycling



Figure 1. Push Tab® packaging [3].

## CASE STUDY Push Tab®

Huhtamaki has partnered with **kp** (Klöckner Pentaplast, also herein profiled) and **Dershlag** to launch the first aluminum-free, mono-material PET blister plug and play solution combined with kpNext<sup>M</sup> R1 bottom rigid film available for the healthcare market [4]. This product has been designed as part of Huhtamaki's circular economy initiative called blueloop, which is a collaborative platform [5][6].

Companies involved: Huhtamaki, kp, and Derschlag

Objective: Substitute current mixed options of plastic and aluminum/PVC

Recyclability: Ready for recycling (100% mono-PET)

**Compatibility:** Fully compatible with current production lines (does not require modifications to existing high performance blister packaging lines, or extra investment)

Application: Pharma/OTC, food supplements, and confectionary. Available in push and peel options (30  $\mu m$  thickness)



Figure 2. Push Tab® blister solution developed with Huhtamaki [4].

## sustainability Huhtamaki

The company has a broad range of sustainable products within their portfolio that could be of interest, and is constantly innovating in many packaging/containers front with many materials, not necessarily just plastics.

For meeting their sustainability goals, the company has launched a '2030 Strategy' committing to a series of climate mitigation targets and gradually transitioning to a circular economy.

Huhtamaki was rated as BBB from MSCI ESG Ratings assessment and a Gold medal by EcoVadis for performance in sustainability in 2022 [7].

About
 LinkedIn
 PushTab
 Sustainable blister packaging

- 5. Blueloon
- 6. Push Tab launch news
- 7. Sustainabili

## Borealis



BOREALIS

Website: www.borealisgroup.com Contact: Contact form HQ: Vienna, Austria Company size: 6,900 employees Founded: 1994

Main GMR focus: Provides advanced and circular polyolefin solutions, as well as base chemicals, fertilizers and mechanical recycling of plastics.

Key differentiator: Commitment with sustainability, decreasing CO<sub>2</sub> emissions, energy consumption, and flaring performance. Borealis was founded in 1994 and is focused on advanced and circular polyolefin solutions, as well as base chemicals, fertilizers and mechanical recycling of plastics. Headquartered in Vienna, Austria, Borealis has 6,900 employees across sites in 120 countries. It generated sales of around USD 7.17 billion in 2020 [1].

**Company provides the following products and services:** advanced and circular polyolefin solutions; base chemicals; fertilizers; mechanical recycling of plastics.





## TECHNICAL DATA Mono-material flexible packaging

Borealis, in collaboration with Borouge, provides laminated and non-laminated mono-material flexible sustainable solutions for pouch packaging, mostly for food [2][3].

The products were developed to attend different purposes:

#### 1) Protection for high loads and hot-filled products

Mono-material: Full PP laminate

Developed in cooperation with Reifenhauser and GEA Food Solutions, it consists of 20  $\mu m$  reverse printed BOPP laminated onto 60  $\mu m$  PP blown film.

#### 2) Long shelf life and high temperature resistance

Mono-material: Cast PP laminate with high barrier properties

Developed in collaboration with W&H, AMAT and GEA Food Solutions, it boasts high barrier properties achieved through the combination of EVOH (<5%) and oxide coating (SiOx, AlOx).

#### 3) Improved machinability and broad sealing window

#### Mono-material: PE

Developed in cooperation with Alpine and GEA Food Solutions, it is made of  $25\mu m$  MDO film laminated onto  $60\mu m$  PE blown film.

## 4) Non-food-contact packaging for high sustainability demanding applications

**Mono-material:** Full PE laminate incorporating >35% Ecoplast PCR r-LDPE (post consumer)

Developed with Alpine and GEA Food Solutions, it is claimed to provide proven excellent printability and machinability on pouch-making equipment.

Depending on the product, different layers can be used containing other products on Borealis portfolio, such as BorShape™, Anteo™ and Queo™ [2][3].



## Mono-material flexible packaging



Figure 1. Pouch packaging made with mono-materials [3].

## **SUSTAINABILITY** Borealis

Borealis also offers other solutions for the circular economy. Greiner Packaging used PP Bornewables<sup>™</sup> from Borealis to produce cup containers for dairy products. Bornewables™ are made from vegetable oil production as well as oil waste and residues. The company reported up to 120% reduction in carbon footprint compared to fossil PP. The prototype is ISCC certified [4][5].

1. About 2. Design for monomaterials 3. Monomaterials media release 4. Bornewables 5. Circular economy

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certified sustainable material BOREALIS

> Figure 2. Cups for dairy products made with Bornewables<sup>™</sup> [4].





## Klöckner Pentaplast



Website: www.kpfilms.com Contact: Contact form on website HQ: London, UK Company size: >6,300 employees Founded: 1965

**Main GMR focus:** Rigid and flexible packaging, and specialty film solutions, serving a variety of markets.

**Key differentiator:** Company received gold rating from EcoVadis [4].

Klöckner Pentaplast was founded in 1965 and is focused on rigid and flexible packaging, and specialty film solutions and is the global leader in recycled content products. Its headquarter is located in London, UK, with over 6,300 employees across sites in 18 countries [1][2]. It generated sales of around USD 2M in 2017 [3].

**Company has the following expertises:** Pharma/medical packaging films; consumer packaging; food packaging; labels, cards, and graphics; home, building, and construction.



## TECHNICAL DATA Pentapharm® kpNext™ R1

KP provides PET pharmaceutical blister films that are crystal-clear, recyclable in RIC stream 1 and designed to meet the client's specific sustainability goals [5]. This product was granted a few different awards. [6]

Solution: Pharmaceutical blister films

Mono-material: PET

Material it is aimed to replace: Vinyl-based materials

**End-use application:** Over-the-counter (OTC), ethicals, generics, nutraceuticals, veterinary medicine

**Advantages:** Compatible with pharmaceutical manufacturing form/fill/seal (f/f/s) equipment, vinyl-free, sustainable, recyclable, superior optical clarity

Production scale: 15,000 metric tonnes of new rPET/PET capacity [8]



Figure 1. Clear blister films made with kpNext<sup>™</sup> [7].

Klöckner



## TECHNICAL DATA kp Elite®

KP provides this modified atmosphere packaging (MAP) alternative for fresh proteins. It can have up to 100% recycled PET (rPET). [10]

Solution: Fresh food packaging

Mono-material: PET

Material it is aimed to replace: Designed without the PE lining

#### End-use application: Trays

**Advantages:** Clarity (only 5% haze), very low haze shrink lidding film, reduced leakage, extended shelf life, reduction in sealing time and temperature, recyclable, very low carbon footprint, maximum strength with minimum weight, reduced food waste

**Case study:** A Life Cycle Assessment was carried out, showing lower environmental impact [11] (considering carbon footprint -, 56.5 CO<sub>2</sub>e against industry average of 69.9 - water and energy used in production, and ReCiPe scores [12]) than similar products. These trays can also be reused within kp's Tray2Tray™ circular initiative.



Figure 2. kp Elite® fresh protein packaging [10].

## SUSTAINABILITY Klöckner Pentaplast

The company has a broad range of sustainable products within their portfolio that could be of interest but were not herein profiled. For instance, KP provides PET-PCR (post-consumer recycled) plastic packaging options that range from 20-100% PET-PCR (SmartCycle®) [9].

For meeting their sustainability goals, the company is actively involved in Ellen MacArthur Foundation's New Plastics Economy Global Commitment. Kp has recently founded ANZPAC Plastics Pact in Australasia, and is a Board member of Petcore, INCPEN and IVK, sits on the BFP management committee and the advisory committee of the UK Plastic Pact [11].

I. LinkedIn
 About
 Company figures
 Company figures
 Company figures
 Convolution
 Converting
 Conv







**Figure 3.** SmartCycle® consumer packaging [9].

## BOBST



Website: www.bobst.com Contact: Contact form HQ: Lausanne, Switzerland Company size: 5,800 employees Founded: 1890

Main GMR focus: Supplies substrate processing, printing and converting equipment and services for the label, flexible packaging, folding carton and corrugated board industries.

**Key differentiator:** Sustainability and innovation driven.

BOBST was founded in 1890 and is focused on machinery, services, packaging, and printing and converting for a variety of industries. It is located in Lausanne, Switzerland, with 5,800 employees. It generated sales of around \$1.6 billion USD in 2021 [1][2][3].

**Company has the following expertises:** Machinery; services; packaging; printing and converting.



#### BOBST **BOBST**

## TECHNICAL DATA ONEBARRIER

BOBST provides oneBARRIER, a full integrated barrier packaging PE structure solution that is transparent (or metalized), ethylene-vinyl alcohol copolymer-free (EVOH-free), and topcoat-free. In this product, the high barrier capabilities are maintained, while the non mono-material content is reduced. This design was accomplished in collaboration with **Dow**, **Zermatt**, and **Sun Chemical** [4].

Solution: oneBARRIER

Mono-material: PE

Material it is aimed to replace: EVOH-based products

**End-use application:** Stand up pouches for food or other consumer goods; any application that requires flexible durable and impermeable packaging

Advantages: Recycle ready

Disadvantages: Still involves other components on the final product



Figure 1. oneBARRIER technology [4].



## SUSTAINABILITY BOBST

BOBST holds a webinar in June 15, 2022 on further development of their oneBARRIER technology, now in its fiber-based derivative [5].



- 1. About
- 2. LinkedIn
- 3. Key Figures
- 4. oneBARRIER

5. Webinar on oneBARRIER

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Figure 2. Illustration of packaging containing the oneBARRIER technology by BOBST [5].

## Zotefoams



Website: www.zotefoams.com Contact: Contact form HQ: Riyadh, Croydon, UK Company size: >500 employees Founded: 1921

Main GMR focus: Leader in cellular material technology, Zotefoams produces lightweight foams for diverse markets worldwide.

Key differentiator: Zotefoams uses an environmentally friendly nitrogen expansion process for their products. Zotefoams was founded in 1921 and is focused on cellular materials and innovation oriented when producing their light-weight foams, high-performance products and technologies. They serve a wide range of industries such as automotive, sports, healthcare, and construction. It is headquartered in Croydon, UK, with over 500 employees among their sites in UK, US, China, and Poland. It generated sales of around \$123 million USD in 2021 [1][2][3].

**Company provides the following services:** Light-weight crosslinked polyolefin block foams; High performance products; Microcellular materials technology.



## Zotefoams

## TECHNICAL DATA ReZorce®

Zotefoams provides a mono-material packaging solution as an alternative to composite packaging for a variety of applications that require oxygen/moisture barrier. HDPE is recyclable in stream 2 and the final material may also include already recycled HDPE for extra sustainability [4][5][6].

Solution: Mono-material barrier packaging

Mono-material: HDPE

Material it is aimed to replace: Composite packaging

**End-use application:** Food and beverage packaging that requires oxygen/moisture barrier packaging

**Advantages:** Recyclable, high quality printing option, may incorporate up to 100% recycled content, compatible with traditional form-fill machines

Disadvantages: Colors added to the packaging might difficult recycling



Figure 1. Packaging made with Zotefoams ReZorce® [4].



## CASE STUDY ReZorce®

A Life Cycle Assessment was carried out for the ReZorce® Circular Packaging for beverage cartons [7].

Companies involved: The LCA Centre, Eco3 Ltd

**Objective:** Assessing how this sustainable option performed and compare it to regular liquid packaging board

**Methods:** Assessment of ReZorce® packaging with 12.5%, 25%, and 50% recycled content

#### **Results:**

- Water used in production: 11 times less water for production
- Global warming potential: 50% lower overall



Figure 2. Packaging made with Zotefoams ReZorce® [7].

## other products Zotefoams

Other products available include: crosslinked polyolefin block foams (AZOTE®)<sup>a</sup>, sales and licensing of high performance products (ZOTEK® and T-FIT®)<sup>a</sup>, and microcellular materials technology (MuCell®)<sup>b</sup> [1].

In 2021, Zotefoams was awarded Best New Concept Award from UK Packaging Awards [8].

Trademarks of <sup>a</sup>Zotefoams plc and <sup>b</sup>Trexel Inc.

1. About

2. LinkedIn

3. Preliminary results news

ReZorce press release

- 5. ReZorce brochure
- 6. ReZorce Circular Packaging website
- 7. ReZone Life Cycle Assessment
- 8. ReZone award



## Nurel



Website: www.nurel.com Contact: Contact form HQ: Zaragoza, Spain Company size: 350 employees Founded: 1968

**Main GMR focus:** Produces engineering polymer, polymer fibers, and biopolymers.

**Key differentiator:** Works on mono-material fibers. Sustainability driven through process design and transparency. Nurel was founded in 1968 and was acquired by SAMCA groups in 1999. Nurel is focused on engineering polymers, polymer fibers, and biopolymers. It is headquartered in Zaragoza, Spain and has 350 employees. It generated sales of around USD 100M. Nurel has production capacity of 27,000 tons for polymers, 14,000 for compounds, and 7,200 tons for nylon yarns [1][2][3].

Company has the following expertises: engineering polymers; synthetic fibers; biopolymers.



## TECHNICAL DATA Promyde®

Nurel provides a mono-material copolyamide among their polyamide Promyde® line - Promyde BF740, BF745 & BF640 [6][7].

**Solution:** Mono-polyamide packaging

Mono-material: Copolyamide

Material it is aimed to replace: Usual layered multi-material packaging

**End-use application:** Thermoformed tray, vacuum bag, packages that require an oxygen barrier to extend the shelf life of food

**Advantages:** 100% recyclable, high temperature resistant, reduces plastic use, oxygen and moisture resistant, sealable, transparent



Figure 1. Promyde vacuum sealed bag [6].

## sustainability Nurel

Nurel offers other products that contribute to the circular economy. Reco Nylon is a recycled nylon 6 yarn 100% made of pre-consumer waste, thus keeping up with the goal of achieving zero waste. It is widely used in sportswear, swimwear, and underwear. It covers a wide range of linear density; texture; and formats, generates 9 times less CO<sub>2</sub>, and uses 9 times less water than regular Nylon production, while keeping the same properties as the original product [4][5].

1. About

2. LinkedIn

- 3. Revenue Information
- 4. Reco Nylon fibers
- 5. Reco Nylon brochure
- 6. Promyde recyclability
- 7. Promyde brochure

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Figure 2. Reco Nylon yarn and production line [4].

## **About the Authors**



Marija Jović Technical Director

Marija is the Technical Director for PreScouter's Chemical, Materials, and Packaging verticals. She has worked across topics such as product and process improvement and development and sustainability throughout the chemicals, materials, and packaging industry. Marija completed her Master's degree in Chemical Engineering from Belgrade University and her Ph.D. in Organometallic Chemistry and Catalysis at the Swiss Federal Institute of Technology (ETH Zurich). Prior to her Ph.D., Marija worked in the chemical industry on the synthesis of new textile dyes.



Priscila Costa Carvalho Project Architect

Priscila is one of PreScouter's Project Architects working primarily in the Chemicals, Materials, and Packaging verticals. She has a solid background in Chemistry and Chemical Engineering and holds an M.Sc. in Chemistry and a Ph.D. in Biochemical Engineering, both from the University of São Paulo (Brazil). Priscila brings to PreScouter years of experience in the research and development of new materials and bioprocesses, working in multidisciplinary teams and in collaboration with industry.



**Julia Siqueira e Silva** Researcher

Julia is a PreScouter Global Scholar Researcher and has worked in a few projects on sustainable raw materials and packaging. She holds a B.Sc. in Chemical Engineering from University of São Paulo (Brazil) and is currently a Ph.D. candidate in Chemical and Biomolecular Engineering at Tulane University (USA). Her research focuses on studying polymerization kinetics to obtain tailor-made polymers. Upon graduation, she aims to use her years of experience to help industries achieve their sustainability goals.

## **Potential Next Steps**

- PreScouter can look for more companies developing technological solutions for mono-material packaging based on your technical and business parameters
- PreScouter can conduct anonymous interviews with companies and researchers
- ✓ PreScouter can organize direct consultations between you and Subject Matter Experts (SMEs) in the space
- ✓ PreScouter can also provide an IP landscape around the topic



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#### PRESCOUTER PROVIDES CUSTOMIZED RESEARCH AND ANALYSIS

PreScouter helps clients gain competitive advantage by providing customized global research. We act as an extension to your in-house research and business data teams to provide you with a holistic view of trends, technologies, and markets.

Our model leverages a network of 4,000+ advanced degree researchers, industrial experts, engineers and analysts across the globe to tap into information from small businesses, national labs, markets, universities, patents, startups, and entrepreneurs.



**Innovation Discovery:** PreScouter provides clients with a constant flow of high-value opportunities and ideas by keeping you up to date on new and emerging technologies and businesses.





**Privileged Information:** PreScouter interviews innovators to uncover emerging trends and non-public information.



**Customized Insights:** PreScouter finds and makes sense of technology and market information to help you make informed decisions.

