LyondellBasell

Mono-material solutions for PP and PE flexible packaging market

Advancing design for recycling (mono-material solutions)

Our industry-leading sustainability ambitions and actions

Leading the way to profitably advance and innovate sustainable solutions

Ending plastic waste

2 MM+ TONS

of recycled and renewable-based polymers produced and marketed annually by 2030

FOR EVERY $

we will invest in venture funds that address the plastic waste challenge; we help catalyze $5 from co-investors

ZERO

plastic pellet loss to the environment from our facilities

1. Our 2050 net zero greenhouse gas emissions goal includes scope 1 and 2 emissions.
2. Relative to 2020 baseline.

Taking climate action

NET ZERO

greenhouse gas emissions from operations by 2050[1]

42%

absolute scope 1 and 2 greenhouse gas emissions reduction from operations by 2030[2]

30%

absolute scope 3 greenhouse gas emissions reduction by 2030[2]

50%

minimum of electricity produced from renewable sources by 2030[2]

Supporting a thriving society

ZERO

incidents, injuries and accidents

ACHIEVE

gender parity in global senior leadership by 2032

INCREASE

the number of people from underrepresented groups in U.S. senior leadership roles to reflect the general population ratio by 2032

ASSESS

a minimum of 70% of our key global suppliers using sustainability criteria by 2025

Improving the sustainability of consumer products

circulen
By LyondellBasell

circulen recover
By LyondellBasell

Polymers made from plastic waste through a **mechanical recycling process**

circulen revive
By LyondellBasell

Polymers made by converting plastic waste into feedstock to produce new polymers using an **advanced (molecular) recycling process***

circulen renew
By LyondellBasell

Polymers sourced from **renewable bio-based feedstocks** such as used cooking oil**

*The advanced recycled feedstock is mixed with our conventional feedstocks in our process and allocated to *Circulen*Revive products using a mass balance approach certified according to the International Sustainability and Carbon Certification (ISCC) Plus standard

**These feedstocks are used in our conventional production processes along with conventional feedstocks and are allocated to *Circulen*Renew products using a ISCC PLUS-certified mass balance approach.

Introducing the Mono Material Packaging solutions: Polyethylene, Polypropylene & Masterbatches for Oriented PP and PE Films

At LyondellBasell, our large integrated footprint allows us to serve global customers and markets.

As many of our materials go into products that people use every day, at LyondellBasell we take our responsibility seriously. We have the potential — and responsibility — to use this scale and reach to make a positive impact. We are working to make meaningful progress to address some of the world's most pressing challenges.

With high demand in plastics packaging, a circular economy model becomes extremely important to take into consideration. A circular economy is a closed system that promotes reuse, encourages value extraction of recoverable material and avoids sending material to landfill.

Therefore, from product design to recycling technologies, the focus is on converting more material into recyclates and maximizing resource efficiency.

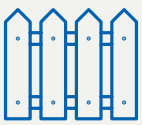
With our polyethylene, polypropylene & masterbatch portfolio and technical expertise we can offer solutions to support the creation of packaging which is designed for recyclability or which incorporates recycled or renewable-based content.

Re-design multi-material to mono-material packaging

With growing demand for circularity, designing packaging today does not only require that the packaging offers performance to keep food fresh and protects the contents, but also that the packaging can be easily sorted and recycled in post-consumer waste streams.

Complex multi-material packaging is more difficult to recycle. Re-designing a multi-material packaging to a mono-material packaging can result in a more recyclable and sustainable solution while maintaining desired properties and performance


Sealing


Barrier

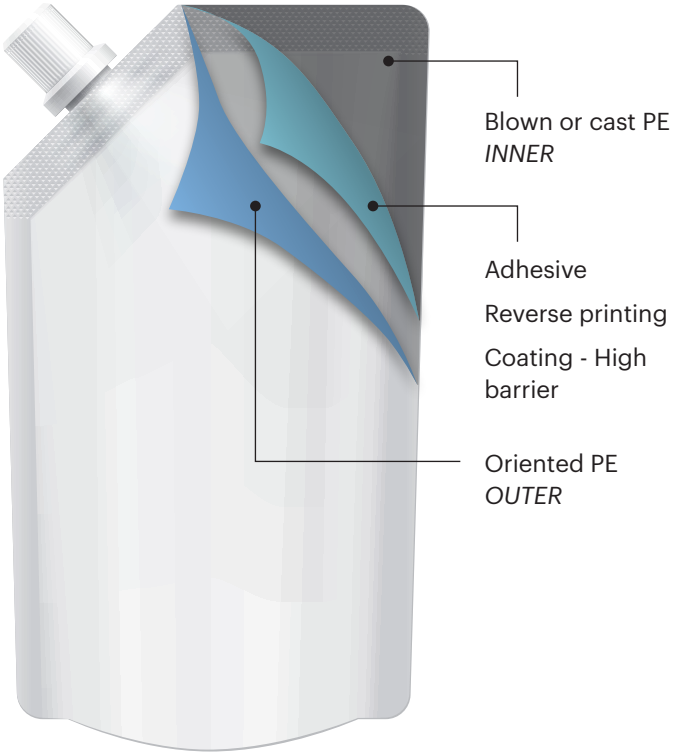

Optics

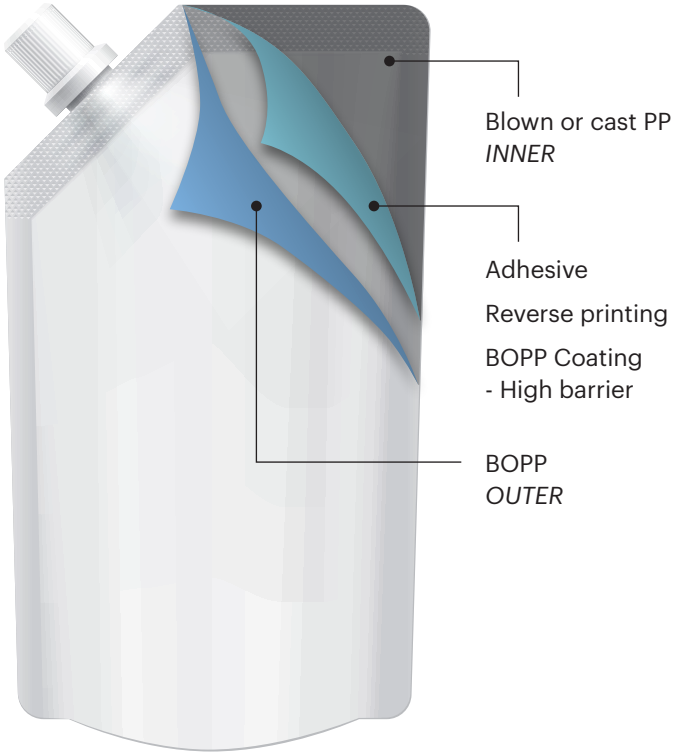

Mechanical


Resistance


Processability

From multi-material packaging to mono-material packaging





Machine Oriented PE film (MDO PE)

- Blown or cast process
- Mono orientation inline or off line
- LLDPE / HDPE

Bi-Axial Oriented PE film (BOPE)

- Tenter frame process
- Sequential or simultaneous stretching in MD & TD
- LLDPE / HDPE

- High temperature resistant layer to replace PET
- High OTR-WVTR barrier layer to replace typical Aluminum
- CPP provides toughness and sealing adjusted with specific skin product for demanding retortable conditions

LyondellBasell produces materials that are key to advancing solutions to modern challenges like recyclability of flexible packaging for high demanding applications.

LyondellBasell offers a full range of products that are suitable for mono-material applications, for all conversion processes: bi-oriented polypropylene film, mono- oriented film (MDO), cast film and blown film.

The plants producing the grades of this portfolio are ISCC PLUS certified, therefore *Circulen*Renew certificates can be provided, addressing the carbon footprint of packaging on top of their recyclability.

Oriented polyethylene films as part of the solution

In multi-material laminates, Oriented PE films allows the substitution of non-polyolefin-based substrates such as bi-axially oriented Polyester (BOPET) or Polyamide (BOPA), in the manufacturing of mono-material PE packaging.

LyondellBasell provides a full range of Polyethylene solutions that meet film structure need:

High performance HDPE used in the skin layer:

- *Luflexen* hyPE 56R FA combines excellent stretchability with outstanding mechanical, thermal & unmatched optical properties.
- *Hostalen* ACP7740F2 combines excellent stretchability with high tensile strength & outstanding optical properties.

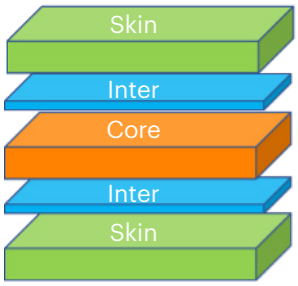
High performance, linear polyethylene grade with medium density used in the intermediate layer:

- *Luflexen* hyPE 35P FA combines outstanding impact resistance with an excellent stiffness and offers good processability in a broad processing window.

Linear low density polyethylene used in the core layer:

- *Petrothene* GA1810 combines maximum strength and toughness.

Example of a MDO PE-film - 25 micron – 5 layers – unblocked:



***Luflexen* hyPE 56P FA**
or *Hostalen* ACP7740F2
+ Polybatch antiblock/ slip
+ Polybatch PPA

***Luflexen* hyPE 35P FA**

***Petrothene* GA1810 (0,918 g/cm³)**

***Luflexen* hyPE 35P FA**

***Luflexen* hyPE 56P FA**
or *Hostalen* ACP7740F2
+ Polybatch antiblock/ slip
+ Polybatch PPA

LyondellBasell Product Portfolio for MDO PE Films:

Reference	Density (g/cm3)	MFR (190/2.16) (g/10min)	MFR (190/5) (g/10min)
Luflexen hyPE 56P FA	0.955	0.75	
Hostalen ACP 7740F2	0.948	0.5	1.8
Luflexen hyPE 35P FA	0.936	0.8	2.5
Petrothene GA1810	0.918	1.0	

LyondellBasell Solutions for Retortable applications

The retort-able solutions offer includes:

- High stiffness homopolymer grades, used in the core layer and outer layers in contact with sealing bars
- Random copolymers, used in the core layer or in the sealing layer
- Copolymers based on Catalloy technology, used as a skin in the sealing layer
- Polybutene-1 grades, lowering and widening the seal initiation temperature window of the sealing layer
- Masterbatches, a wide range of additives and white masterbatches

Polypropylene, *Catalloy* and Polybutene-1 (PB-1) Resins

Polypropylene resins enable mono-material – ready for potential recycling – solutions. LyondellBasell recently broadened its family of retort grades by bringing to the market a family of products based on non-phthalate catalyst and designed to advance sustainability. Those grades are aimed at replacing PET or PA in complex film structures, while providing downgauge and improved properties. They are also available as *Circulen*Renew, helping brands on their journey towards carbon neutrality.

Homopolymers

LyondellBasell offers a wide range of homopolymers for all needs and applications, featuring MFR (230°C/2,16 kg) from 0.8 to 9 g/10 min, which are suitable for retorting. Products of increased stiffness, with flexural modulus up to 2200 MPa, help downgauging the film structure and allow mono- material solutions.

Adstif HA622M

This grade is a very high stiffness non-phthalate homopolymer with high thermal stability. It is designed for hot filling applications requiring rigidity; it is suitable for high-speed lines. With MFR 7 g/10 min (2.16 kg/230°C), *Adstif* HA622M is nucleated and achieves a tensile modulus of 2200 MPa.

Adstif HA620J HP

Adstif HA620J HP is a non-phthalate low catalyst residuals homopolymer. With MFR 3 g/10 min (2.16 kg/230°C), it is appreciated by BOPP customers for its enhanced processability on high-speed lines.

Adstif HA622H

This high cristallinity non-phthalate homopolymer offers good optical properties, increased film rigidity and barrier. With MFR 2 g/10 min (2.16 kg/230°C) it is designed for the production of biaxially oriented polypropylene films (BOPP), including metallizable films and both plain and coextruded structures.

Random and hetherophasic copolymers

When it comes to mono-material solutions for food applications requiring thermal resistance, the main challenge is providing a structure that is sealable and retort-able at the same time, while keeping good seal strength and barrier after retorting. LyondellBasell offers a wide range of random and heterophasic copolymers suitable for that scope.*

Moplen RP410M HP

This random copolymer, MFR 7 g/10 min (2.16 kg/230°C), is designed to be employed in the sealing layer of mono-material structures for high retorting applications. Main features are high melting temperature, broad processability window and high seal strength after retorting. It is appreciated in BOPP as well as in cast structures due to its good processability and optical properties.

Moplen EP310D HP

This heterophasic copolymer, MFR 1 g/10 min (2.16 kg/230°C) represents an industry benchmark when it comes to cast and blown film high retorting applications. It exhibits superior mechanical properties and delivers high impact and thermal resistance over a broad range of temperature. Low fluidity, does not contain anti-blocking and slip additives.

Moplen EP310J HP

This heterophasic copolymer, MFR 3 g/10 min (2.16 kg/230°C), is suitable for high retorting conditions. It is nucleated and has a higher fluidity and increased transparency when compared to EP310D HP. It offers high thermal stability for food sterilization, high seal strength and seal integrity and exhibits high impact, good puncture and good tear resistance.

Moplen EP310M HP

This heterophasic copolymer, MFR 7.5 g/10 min (2.16 Kg/230°C), offers great balance between impact properties (at room and low temperatures) and stiffness, while featuring good puncture and tear resistance, high seal strength and seal integrity. Optimal processability on cast film lines.

* The compliance to the requirements of Regulation 10/2011/EC (in terms of OML and SML determinations) are the responsibility of the manufacturer of the finished plastic food contact material or article

Catalloy

No spills and no contamination of your product!

Used as sealing layers (modifiers) in cast and blown film structures, the family of *Adflex* Q 100 F and *Adflex* C 200 F provides a food compliant, good organoleptics and high performance solution for stand-up pouches for retorting at 125 - 140° C. Also available in non- phthalate versions as *Adflex* Q 190 F and *Adflex* C 290 F.

When used as blending partner in 15-20% in sealing layer, *Adflex* Q 100 F/Q 190 F and *Adflex* C 200 F/ C 290 F show:

- Stiffness
- Toughness at low and high temperatures
- Tear and puncture resistance
- Retorting stability
- Low gel content

Polybutene-1 (easy-peel/peel-seal feature)

LyondellBasell grouped products used in easy-peel technology for PP film with the *Toppyl* C range.

Customers use these products in a broad range of film extrusion technologies like cast film, blown film, sheet extrusion and BOPP to easy-peel to PP and to itself (bags/pouches).

Typically, *Toppyl* C used in multilayer PP retort-able solutions are:

Toppyl SP 2101 C

This grade is used by customers for heat-sterilizable applications, which require an average peel force ± 3 – 4 N/15mm ** before film lamination. *Toppyl* SP 2101 C is fully formulated with slip and antiblock agents.

Toppyl SP 2103 C

In case customers need an easy-peel solution with a higher peel force compared to *Toppyl* SP 2101 C and still to PP for heat-sterilizable applications, LyondellBasell has developed *Toppyl* SP 2103 C.

The average peel force of *Toppyl* SP 2103 C is around ± 6 – 8 N/15mm ** before film lamination.

Toppyl SP 2103 C is a barefoot material and it does not contain slip and antiblock additives.

* The *Toppyl* C grades will be available as non-phthalate (NP) versions from 2023 onwards and will replace the today (ZN) versions. Both versions (ZN and NP) will be commercially available till the end of 2023. Starting from Q1/2024, only the NP versions will be available

** Results measured with internal LYB test method, non-laminated cast film against non-laminated PP cast film - based on ASTM D882-90

*** For regulatory compliance information, see Product Stewardship Bulletin (PSB) and Safety Data Sheet (SDS). To obtain copies of these documents, please contact your LyondellBasell product safety representative.

Masterbatches

LyondellBasell provides a full line of additive & white masterbatch solutions that can be customized to meet film structure need.

Additive concentrates that enhance the appearance, performance and processability of resins for the:

- Film extrusion by cast- & blown process, MDO-PE, BOPP- & BOPE films
- Final packaging

A selection can be made upon the converting process:

- HFFS / VFFS
- Lamination and reverse or surface printing
- Coatings and Enhanced Vacuum Deposition Process (PECVD) of Al, SiOx and AlOx
- Heat process of pasteurization, hot fill, semi and high retortable applications.

Next to the standard product portfolio, in addition new functional masterbatches have been developed to enhance further the sorting and recycling of flexible packaging.

Functionality	*Polybatch* / *Polywhite* Types & features	Description
Antiblocking	Standard Low abrasion Low COF	The addition of antiblock in films prevents their tendency to stick together (block). A variety of antiblock masterbatches are available. Selection can be made depending on the required film properties (optical properties, surface roughness, scratch resistance). Specific masterbatches are available for the Enhanced Vacuum Deposition Process (PECVD) of Al, SiOx and AlOx. Special antiblock agents can be applied as non-migrating slipping agent.
Slip & combined Slip / Antiblocking	Migrating Non-migrating Permanent	The reduction of film to metal and film to film coefficient of friction (COF) enables higher processing and handling speeds. A variety of slip masterbatches are available providing low, medium and high COF reduction with a short, long or permanent performance in packaging film. Combined Slip / Antiblocking masterbatch are available, reducing complexity in film recipes.
Antistatic	Long term Short term Broad FC compliancy	The antistatic agents prevents electrostatic charges typically caused by friction between two materials for example in the production and converting of packaging film. Antistatic agents keeps packed goods free of dust. Short- and long term antistatic performance masterbatches are available with broad Food Contact Compliancy.
White	*Polywhite*	LYB offers a wide range of high quality white masterbatches up to 80% titanium dioxide. *Polywhite* provide the packaging film high opacity and whiteness combined with high gloss. These masterbatches are appropriate for labels, lamination film, high quality print and many other applications.
Processing aid	*Polybatch* PPA	Processing aids can be applied for multiple purpose. For instance, reduction of die deposits, improving co-extrusion of polymers with different melt viscosities and lowering filter pressure. In combination with enhanced appearance of film surface and clarity.
Heat & process Stabilizer	*Polybatch* AO	Antioxidants can protect polymers during processing as well throughout the package lifetime. Antioxidants also enable the use of recycled content in packaging by managing color-gel formation from polymer degradation.
Polymer modifier	*Polybatch* CPS	CPS masterbatches facilitate the extrusion and stretchability of polymers. Adding *Polybatch* CPS enhance appearance in transparency and further increase of stiffness and barrier properties.
Antifog	*Polybatch* AF	*Polybatch* anti-fog grades prevent condensation of water vapor on the surface of a plastic film. They keep packaging transparent, attractive and avoid the spoilage of the packed food. Anti-fog masterbatches offers short and long-term antifog performance. Typically applied in cold-fog applications such as fresh produce, meat, and refrigerated food packages as well as in hot-fog applications where food may be cooked or kept hot.
Matt	*Polybatch* DUL	*Polybatch* DUL grades provide packaging film a matt appearance or a soft-touch feel by co- extrusion and create a significant product differentiation. A full range of matt compounds is offered for lamination and heat-sealable films with different Seal Initiation Temperatures (SIT).
Cavitating	*Polybatch* PF	*Polybatch* PF portfolio provide cavitation to oriented films – caused by inorganic or polymeric particles in the core layer – that occurs during orientation. The well-defined voids create a lower density, opacity, whiteness and pearlescent effect. *Polybatch* PF can be applied for labels, candy and chocolate bar wrappers and general overwrap film.

About us

We are LyondellBasell (LYB) – a leader in the global chemical industry creating solutions for everyday sustainable living. Through advanced technology and focused investments, we are enabling a circular and low carbon economy. Across all we do, we aim to unlock value for our customers, investors and society. As one of the world's largest producers of polymers and a leader in polyolefin technologies, we develop, manufacture and market high-quality and innovative products for applications ranging from sustainable transportation and food safety to clean water and quality healthcare. For more information, please visit www.lyb.com or follow @LyondellBasell on LinkedIn.

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