



Exceed™ Stiff+

Enhance laminated packaging performance with Exceed™ Stiff+ metallocene polyethylene

Creating stiffer, tougher, more durable flexible packaging often requires multiple resins, more blending, and sacrifices in conversion efficiency. What if your resin did more? Exceed Stiff+ PE grades deliver simplicity without compromise. Now you can get high performance with easy processing; stiffness and toughness with less blending, and resin solutions that simplify operations and improve package durability.



Increase package durability



Enhance performance without compromise

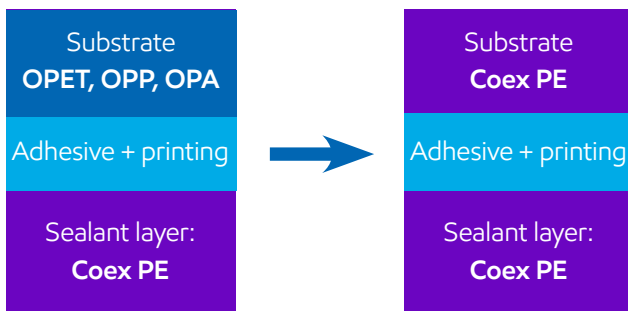


Reduce operational complexity by using simpler structures

Data and results presented herein apply specifically to the noted application under this fact sheet. Your results may differ depending on factors such as operating conditions, equipment and materials used.

The inherent stiffness and toughness of Exceed Stiff+ resins significantly enhance the performance and durability of PE//PE laminates. This enables larger pouch sizes that accommodate more aggressive contents than was previously possible in full-PE packages, helping expand market usage of mechanically recyclable packages*.

Full-polyethylene laminates



A strong full-PE laminate starts with a stiff, strong sealant film. Exceed Stiff+ PE grades deliver differentiated performance in full-PE laminated packaging by significantly increasing the stiffness and toughness of the sealant web so that it can further reinforce the performance of the full-PE print web produced by machine direction orientation (MDO).

* Recyclable in the few communities with programs and facilities in place that collect and recycle plastic film.

As shown in Figure 1, using Exceed™ Stiff+ m 0820.ML performance polyethylene with a bit of HDPE or using the Exceed™ Stiff+ m 0926.ML grade neat was sufficient to replace the 0.920d ZN C8LL + 15% HDPE blend and replace the 0.916d competitive product in the sealant skin with the lower density 0.912d Exxtra™ Seal m 1012 resin. The end result is a sealant web exhibiting comparable stiffness and improved toughness using fewer resins.

Figure 1

	Reference	Exceed Stiff+ m 0820.ML	Exceed Stiff+ m 0926.ML
60µm 1 / 3 / 1w			
Sealant skin ¹	mLL C8 (1.0; 0.916) + 10% LD 07523	Exxtra Seal m 1012 + 10% LD 07523	Exxtra Seal m 1012 + 10% LD 07523
Core ²	ZN C8 (1.0; 0.920) + 15% HDPE ³	Exceed Stiff+ m 0820.ML ⁴ + 10% HDPE ³	Exceed Stiff+ m 0926.ML
Skin ¹	Exceed™ m 1018		

1. Skins contain 1% slip + 1.5% anti-block
2. Core contains 1% slip
3. Film formulation designed to have same average film density with less HDPE content (around 0.921g/cm³)
4. The Exceed Stiff+ m 0820.ML resin had an MI of 0.65 g/10 min versus the product target of 0.80 g/10 min at 190°C & 2.16kg.

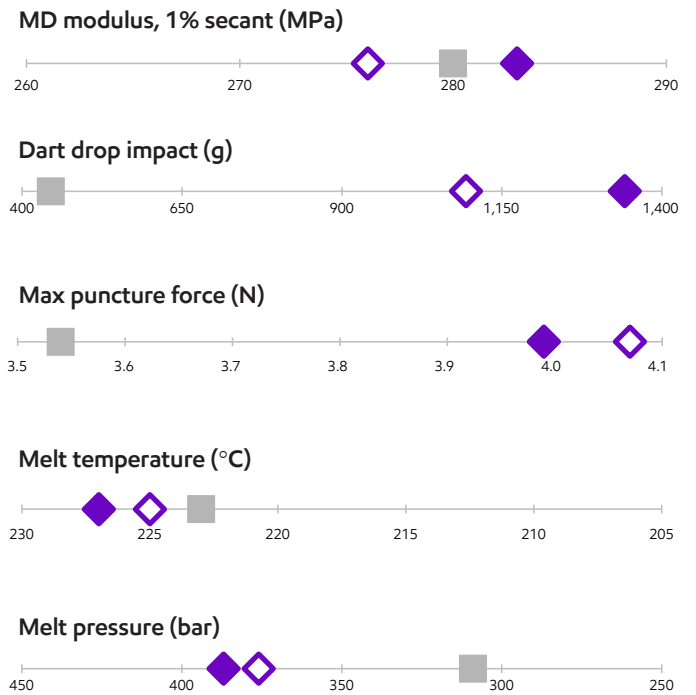
A robust full-PE print web solution designed for high gloss and low haze is shown in Figure 2. Details on this structure can be found in the previously published PE//PE case study.

Adhesively laminating the sealant and print webs produces the structure shown in the table below, along with key performance dimensions. Depending on the Exceed S PE grade used, you will see a significant increase in dart drop impact with no loss and, in some cases, even an increase in stiffness relative to the reference. In both instances, the haze of laminates made from Exceed Stiff+ m 0820.ML and Exceed Stiff+ m 0926.ML resins is comparable to that of the reference and could likely be improved through further optimization.

Figure 3

	Reference	Exceed Stiff+ m 0820.ML	Exceed Stiff+ m 0926.ML
60µm 1 / 3 / 1			
Sealant skin ¹	mLL C8 (1.0; 0.916) + 10% LD 07523	Exxtra Seal m 1012 + 10% LD 07523	Exxtra Seal m 1012 + 10% LD 07523
Core ²	ZN C8 (1.0; 0.920) + 15% HDPE ³	Exceed Stiff+ m 0820.ML ⁴ + 10% HDPE ³	Exceed Stiff+ m 0926.ML
Skin ¹	Exceed m 1018		
Adhesive	25µm MDO PE of Exceed Stiff+ m 0238, Exceed Tough+ m 0516 and HDPE		
Substrate	25µm MDO PE of Exceed Stiff+ m 0238, Exceed Tough+ m 0516 and HDPE		

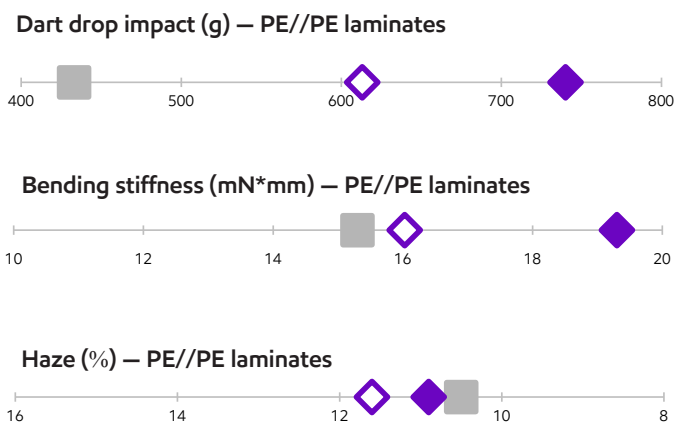
1. Skins contain 1% slip + 1.5% anti-block
2. Core contains 1% slip
3. Film formulation designed to have same average film density with less HDPE content (around 0.921g/cm³)
4. The Exceed Stiff+ m 0820.ML resin had an MI of 0.65 g/10 min versus the product target of 0.80 g/10 min at 190°C & 2.16kg.



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Figure 2

PE MDO Film	25 µm 1/1/2/1/1 - MDO ratio 4.8
Printed skin	Exceed™ Stiff+ m 0238 and Exceed™ Tough+ m 0516
Sub-skin	ExxonMobil HDPE
Core	Exceed Tough+ m 0516
Sub-skin	ExxonMobil HDPE
Outer skin	Exceed Stiff+ m 0238 + ExxonMobil HDPE



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The laminated film produced from the reference and both sealant webs based on Exceed™ Stiff+ resin were all converted into two types of vertical form, fill and seal (VFFS) bags to assess real-world performance using a bag drop test. The contents and details of the drop testing are provided in Figure 4 and the survival rates of the packages themselves have been consolidated in Figure 5.

Note that the package type and bag drop methodology varied and so no direct comparison of bar height can be made between the liquid and solid packaging. Rather, the heights of the of two Exceed Stiff+ resin structures should be compared to the reference in each type of packaging. Doing so reveals that the solutions containing the stiff, tough core layers of Exceed Stiff+ polyethylene and upgraded skins enabled by such, delivered significantly better performance than the reference for both types of laminated packaging tested.

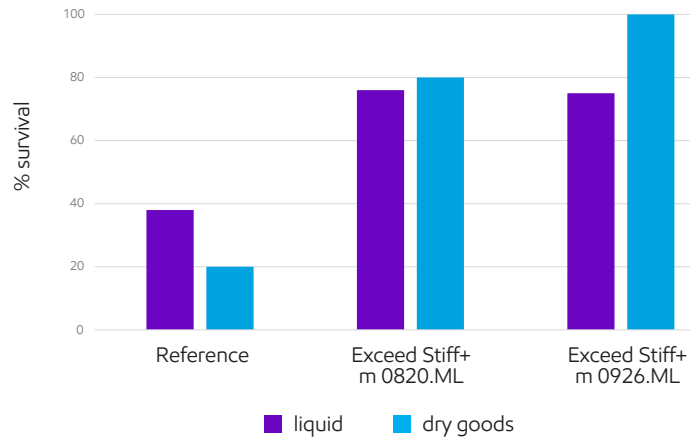
Figure 4

Bag drop - Laminated VFFS bags
Failure on the wall of the bags

Package type	Test methodology
1.5 liter water pouch	20 bags, progressive drops @ 1-3m
2.5 kg dry goods pouch (simulated using resin pellets as the contents)	4 bags, 4 successive drops @ 5m

Grade	Melt index (g/10 min)	Density (g/cm ³)	Slip / anti-block
Exceed™ Stiff+ m 0820.ML	0.80	0.920	No
Exceed™ Stiff+ m 0926.ML	0.85	0.926	No
Exceed™ Stiff+ m 2025.ML	2.0	0.925	No

Figure 5



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Summary

Full-PE laminated packaging based on Exceed Stiff+ performance polyethylene resins and MDO-based print webs using other ExxonMobil products delivers robust performance rivaling that of PE//PET laminates. Sealant webs based on Exceed Stiff+ resins exhibit differentiated toughness and stiffness relative to market references, therefore unlocking opportunities to expand the range of products that can be packaged.

Data from tests performed by or on behalf of ExxonMobil

Test item	Test method
Melt Index (MI)	ExxonMobil test method following principles of ASTM D-1238 or supplier datasheet
Density	ExxonMobil test method following principles of ASTM D-4703 and ASTM D-1505 or supplier datasheet
Dart drop impact resistance by free falling dart	ExxonMobil test method following principles of ASTM D-1709
Tensile properties on film	ExxonMobil test method following principles of ASTM D-882-18
Puncture	ExxonMobil test method



Bring your impossible

ExxonMobil Signature Polymers was born from the belief that people fuel progress. From automotive and construction to packaging, agriculture, industrial, and beyond, we leverage the scale and reach of ExxonMobil to deliver the insights and innovations that empower our diverse, global partners to take their businesses to new heights. We continuously work to provide the listen-first, service-driven, game-changing collaboration that unlocks opportunities for our partners and advances and business goals.



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What's new: ExxonMobil Signature Polymers

All our polymers are now positioned under a single portfolio brand: Signature Polymers. The aim is to simplify our product architecture and naming to improve portfolio navigation for you. We would like to stress that our commitment to high quality products remains the same, it is the names that change. Everything else remains the same. We will be making these modifications over the next six months so you will see both old and new grade names highlighted during that time.

Here's a quick overview of brands and grade names that have changed in this document:

Legacy commercial name	New commercial name
Exceed™ S 9272	Exceed™ Stiff+ m 0820
Exceed™ S 9243	Exceed™ Stiff+ m 0926
Exceed™ S 9333	Exceed™ Stiff+ m 2025
Exceed™ XP 8656	Exceed™ Tough+ m 0516
Exceed™ 1012	Exxtra™ Seal m 1012
Exceed™ 1018	Exceed™ m 1018
Enable™ 4002	Exceed™ Stiff+ m 0238
ExxonMobil™ LDPE 150	ExxonMobil™ LD 07523

Some of our existing Exceed, Achieve, Paxon and premium PP/HD grades have moved to Exceed brand; most existing Enable grades have moved to Exceed Flow[+]; most of our existing Exceed XP grades have moved to Exceed Tough[+]; most of our existing Exceed S grades have moved to Exceed Stiff[+]. More details here https://www.exxonmobilchemical.com/en/brands/signature-polymers/exceed_high_performance_polymers or contact your ExxonMobil representative to know more.

Want to see what's changed in our portfolio? Go to [exxonmobilchemical.com/sptransform](https://www.exxonmobilchemical.com/sptransform)