ExxonMobil
Signature Polymers

Case Study

Exceed™ Flow+ Exceed™ Stiff+ Exceed™ Tough+ Exxtra™ Seal

# Recyclable* 97% PE barrier pouch packaging with high oxygen barrier, unique optics and outstanding package integrity

Recyclable* | Outstanding oxygen barrier | Tremendous optics | Outstanding package integrity

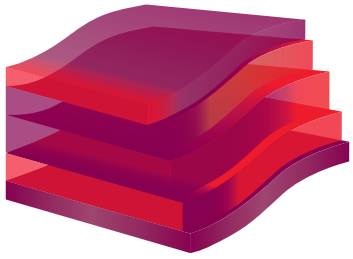
## Challenge

To create a >95% PE high oxygen barrier pouch - as an alternative to more difficult to recycle multimaterial high oxygen barrier laminates - with unique aesthetics through digital printing.


## MDO-PE film

**Thickness: 25µm**

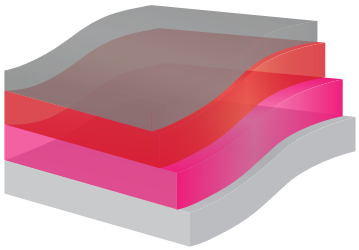
- Exceed Tough+ m 0516.ML
- Exceed Stiff+ m 0238.MC
- Exceed Flow m 0527.MC
- ExxonMobil HD



## Lamination & barrier coatings layer

**Basis weight: 4.8gsm**

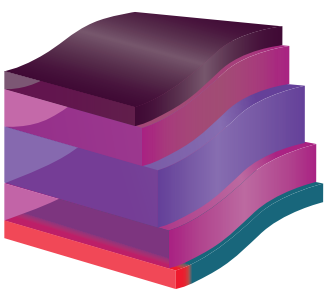
- Vacuum-coated AlOx
- Henkel top coating
- Printing ink
- Henkel PU adhesive



## PE sealant film

**Thickness: 120µm**

- Exceed™ Tough+ m 0814.ML
- Exceed™ Flow+ m 0938.MC
- Exceed™ Stiff+ m 0926.ML
- Exxtra™ Seal POP 2008.MK
- ExxonMobil™ LD



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

HOSOKAWA ALPINE | Henkel | erema group | nordmeccanica group | KARLVILLE BEYOND CONVERTING | HP Indigo

# Solution

**Using the latest technology in polymers and conversion and through a unique value chain collaboration, the team was able to create a 97% PE pouch with high oxygen barrier, unique optics thanks to HP Indigo digital printing and very good package integrity.**

This blown film was produced with ExxonMobil best-in-class performance polyethlyene resins and made on an Alpine 5-layer line with inline MDO. This state of the art MDO technology offers film quality with outstanding processability and optimized flatness.

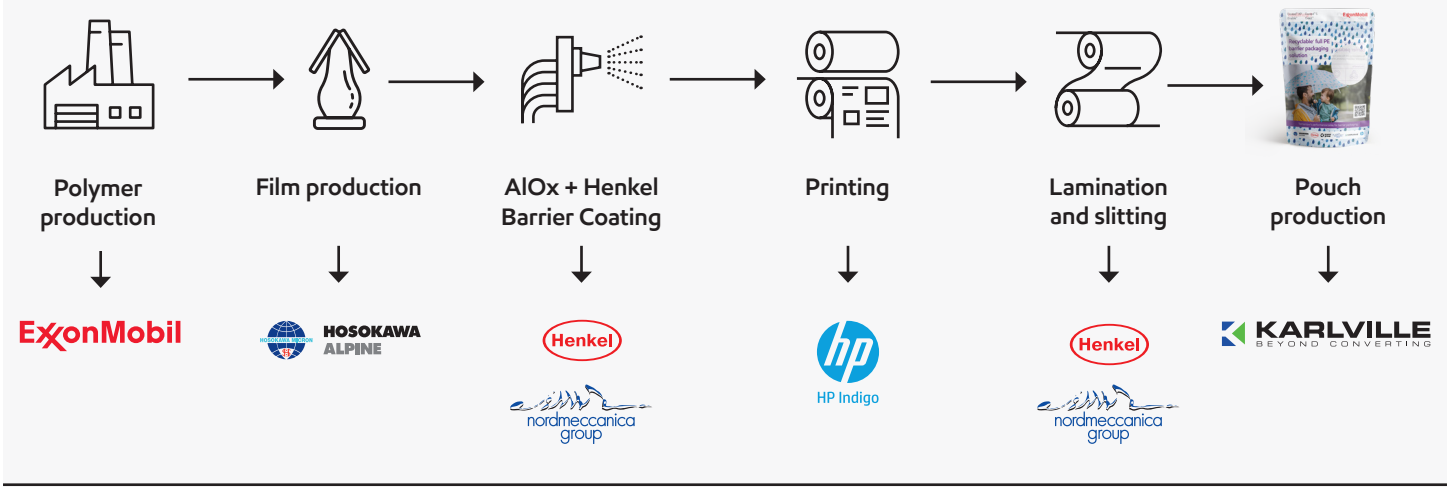
Two extremely thin functional layers were then applied on the MDO-PE to deliver outstanding barrier properties: the first layer consisted of 10 nanometers of uniform and homogeneous AlOx, while the second layer consisted of 1 micron of Henkel's newly developed Barrier Coating.

Both functional layers were applied using Nordmeccanica's Vacuum & Coating technologies [Nordmet 12F Plus / Super Combi 5000]. These technologies offer industry leading performance in terms of reliability, uniform laydown, thickness control and energy consumption.

Subsequently, the film was printed by HP using digital printing technology on an HP Indigo 25K press.

In the following step, the MDO-PE was laminated with the sealant web on a Nordmeccanica SC 5000 Coating-Laminating machine by using Henkel's customized SL adhesives, designed for mechanical recycling.

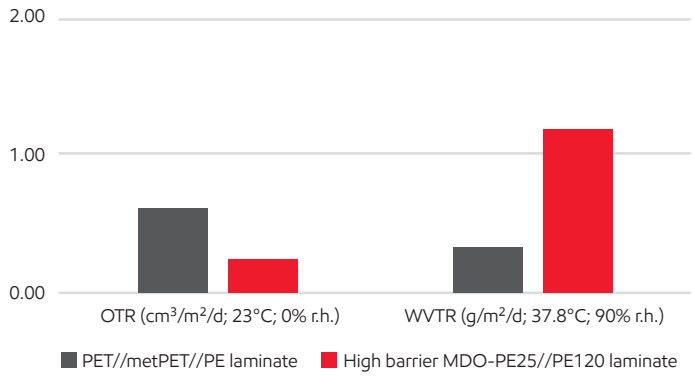
And finally, the pouches were converted by Karlville with the latest pouch machine KS-DSUP-400 model.




## Barrier properties

This pouch incorporates the innovative concept of AlOx and barrier coatings – to produce a very high PE content (97%) pouch while still providing high OTR (~0.25 $cm^3/m^2/d$) and WVTR (~1.2 $g/m^2/d$;) values comparable to less recycle-ready low barrier structures, as can be seen from Graph 1.

### Graph 1 - Oxygen and moisture barrier*

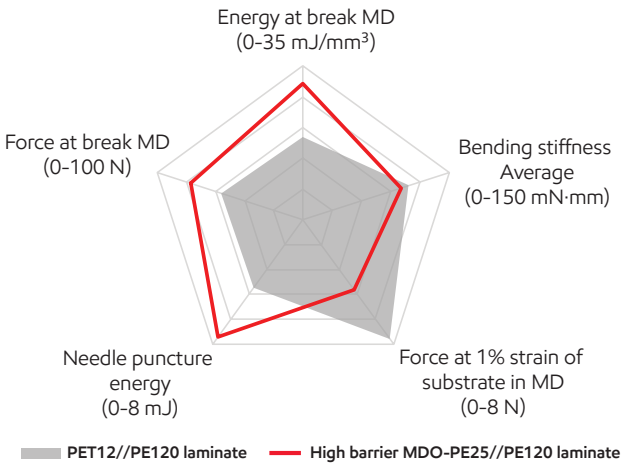



*All barrier values are to be considered as indicative as they may strongly depend on various parameters and test conditions

## Mechanical properties

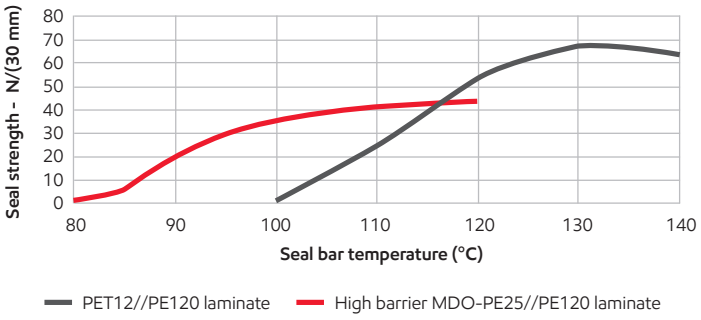
This pouch features the latest PE resin to deliver outstanding package integrity – resulting in an improvement in puncture and force at break of respectively 60% and 70% versus comparable alternatives, while keeping comparable bending stiffness to maintain stand-up ability.

### Graph 2-Mechanical properties



In addition, the pouch features the Exxtra™ Seal POP-series sealant materials to lower the Seal Initiation Temperature.

### Graph 3 - Seal Strength

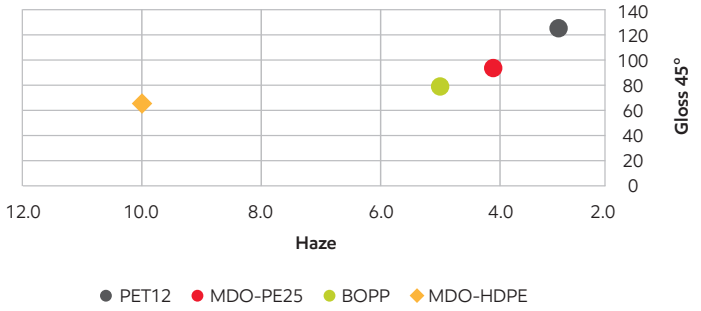



This pouch also includes HP Indigo digital printing technology, which allows printing to make each pouch look unique.

### Optics

The MDO substrate also does not compromise on shelf-appeal with outstanding gloss (~93 GU) & low haze (~4%), rivaling the best-in-class PET substrate, as can be seen in Graph 4.

### Graph 4 - Optical Properties




| Test item | Test method |
|---|---|
| Oxygen transmission rate (OTR) | ExxonMobil test method |
| Water-vapor transmission rate (WVTR) | ExxonMobil test method |
| Tensile properties on film at room temperature | ExxonMobil test method |
| Puncture - needle test | ExxonMobil test method |
| Heat seal strength at RT | ExxonMobil test method |
| Bending stiffness | ExxonMobil test method |
| Haze | Based on ASTM D-1003-13 |
| Gloss 45° | ExxonMobil test method |

Contact us for more information: **exxonmobilchemical.com/pe**

ExxonMobil Signature Polymers

**Bring your impossible**

# 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™ XP 8656ML | Exceed™ Tough+ m 0516.ML |
| Enable™ 4002MC | Exceed™ Stiff+ m 0238.MC |
| Enable 2705MC | Exceed™ Flow m 0527.MC |
| Exceed XP 8784ML | Exceed Tough+ m 0814.ML |
| Enable 4009MC | Exceed™ Flow+ m 0938.MC |
| Exceed™ S 9243ML | Exceed Stiff+ m 0926.ML |
| Exact™ 3237 | Exxtra™ Seal POP 2008.MK |

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**