ExxonMobil
Signature Polymers

Factsheet

Exceed™ Tough  Vistamaxx™

# Creating Machine Wrap stretch film incorporating up to 30% post-consumer recycled (PCR) content while maintaining performance

- Incorporates recycled content
- Maintains mechanical performance
- Reduced gel impact
- Improved wrapper consistency

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.

## Challenge

### Incorporate PCR content while maintaining stretch film performance

Traditional LLDPE-based solutions can provide moderate pallet stability, with little to no downgauging possibility without adding a booster such as performance polyethylene. These type of films are often unable to incorporate recycled content while maintaining mechanical performance.

"Customers can struggle to incorporate PCR into their stretch wrap solutions," said Marie-Paule Van Den Eede, PE Technology, Customer and Application Developer, ExxonMobil. "PCR feedstock typically contains LDPE, which can be detrimental to stretch film performance due to a potential reduction in stretchability, which can compromise film end-use properties. In addition, PCR typically exhibits gels, which can be detrimental to stretch film performance due to the potential creation of holes and reduced stretchability. A C4-LLDPE-based formulation incorporating PCR may not deliver the film and end-use level of performance required for machine wrap stretch films. We were eager to propose a potential solution that could overcome these challenges."

## Solution

### ExxonMobil performance polymers for improved mechanical performance and improved wrapper consistency

ExxonMobil offers performance polymers that can allow the delivery of high-end Machine Wrap stretch film solutions incorporating up to 30% PCR while maintaining performance.

**Exceed™ Tough m 3812.CB performance polymer as an excellent PCR blend partner and booster grade**

- Higher melt index and lower density (vs reference performance PE (0.918 g/cm$^3$; 3.5 g/10 min)), exhibiting improved mechanical performance and processing capability
- Especially suited as a blend partner with PCR content
- Acts as a gel grinder, reducing the impact of gels and helping improve wrapper consistency

**Vistamaxx™ 6000 performance polymer functional layer as a consistency booster**

- Metallocene catalyzed copolymer that can provide improved ultimate stretch, tear propagation resistance and wrapper consistency
- Can be used pure in a functional layer of 10-15% (of the overall structure), while maintaining full compatibility with PE flexible film recycling streams.[1]

[1] The terms "recyclable" and "recyclability" are intended to refer to the potential for recyclability of packaging solutions designed and manufactured in accordance with recycling guidelines such as RecyClass (https://www.recyclass.eu/) and are limited to Europe. Ultimate recyclability of packaging incorporating ExxonMobil's performance PE resins will depend on a number of factors outside of ExxonMobil's control including, but not limited to, availability of programs and facilities that collect and recycle plastic packaging within a given community. Any and all claims about the recyclability of packaging are the sole responsibility of the packaging manufacturer. https://recyclass.eu/wp-content/uploads/2024/03/2023-PO-011012-vf.pdf

# Results

**Incorporating up to 30% PCR into a high-end machine wrap film was achieved with the incorporation of performance polyethylene, which helped to maintain mechanical properties**

ExxonMobil testing indicated that C4-LLDPE based formulations with the incorporation of PCR performed poorly. A C4-LLDPE-based formulation may not deliver the film and end-use level of performance required unless high quality recycled content is used.

When testing ultimate stretch force, C4-LLDPE film with 20% PCR broke earlier than the reference solution without PCR. The C4-LLDPE film with 20% PCR also performed poorly in consistency testing.

"The results help to emphasize the important role that ExxonMobil performance polyethylene can play when incorporating PCR," said Marie-Paule. "In this example, replacing C4-LLDPE with Exceed™ Tough m 3812 as a booster grade and PCR blend partner helped to maintain mechanical performance and wrapper consistency for machine wrap stretch films."

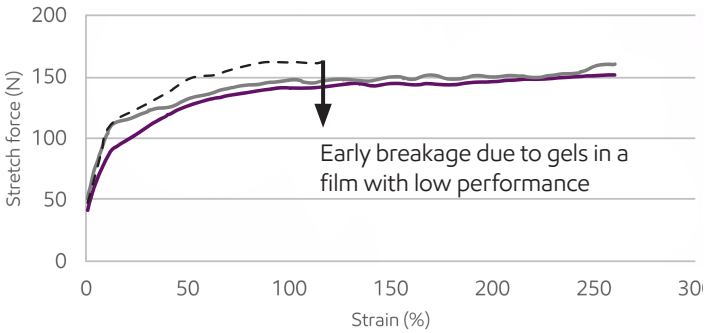
**Introducing Vistamaxx™ performance polymer 6000 for higher wrapper consistency, which can be used pure in a functional layer of 10-15% of the overall film structure**

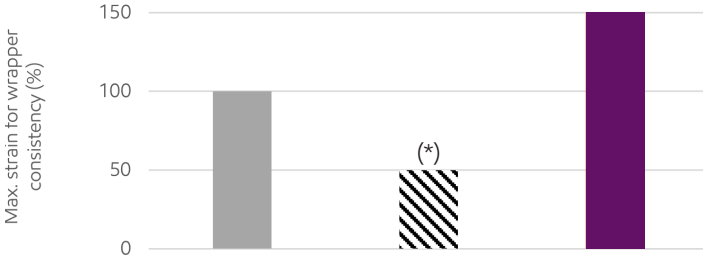
"Hole formation is often due to the presence of gels, even if a hole appears during film application (i.e., stretching)," said Marie-Paule. "The functional layer of Vistamaxx 6000 can act as a wrapper consistency booster and help prevent further hole tear propagation."

Therefore, Vistamaxx 6000 performance polymer in the functional layer can offer the following potential benefits:

- Wrapper consistency
- Maintained packaging integrity and performance
- Full compatibility with European PE flexible film recycling streams per RecyClass certification in amounts up to 15% of the total structure.[1]

**FPT Ultimate Stretch Force (at 4m/s)**

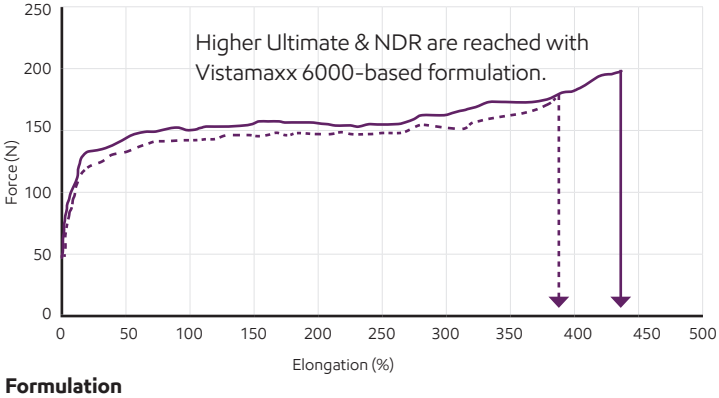



(*) *Hole formation during test*

| | **C4 LLDPE reference** 17 µm | **C4 LLDPE + 20% PCR** 17 µm | **Exceed Tough m 3812 performance polymer + 20% PCR** 17 µm |
|---|---|---|---|
| Ratio | 1 / 8 / 1 | 1 / 8 / 1 | 1 / 8 / 1 |
| Anti-cling | 100% LL1004AY | 100% LL1004AY | 100% LL1004AY |
| Core | 100% LL1004AY | 100% LL1004AY **25% PCR2** | **75% Exceed Tough m 3812.CB** 25% PCR2 |
| Cling | 95% LL1004AY 5% Vistamaxx 6202 performance polymer | 95% LL1004AY 5% Vistamaxx 6202 | 95% LL1004AY 5% Vistamaxx 6202 |

**FPT Ultimate Stretch Force (at 4m/s)**




**Formulation**

— Exceed Tough m 3812 performance PE-based structure incorporating 30% PCR

- - - Exceed Tough m 3812 performance PE-based structure incorporating 30% PCR and with Vistamaxx™ 6000 as functional layer

**Wrapping consistency %**

— 200%

- - - 250%

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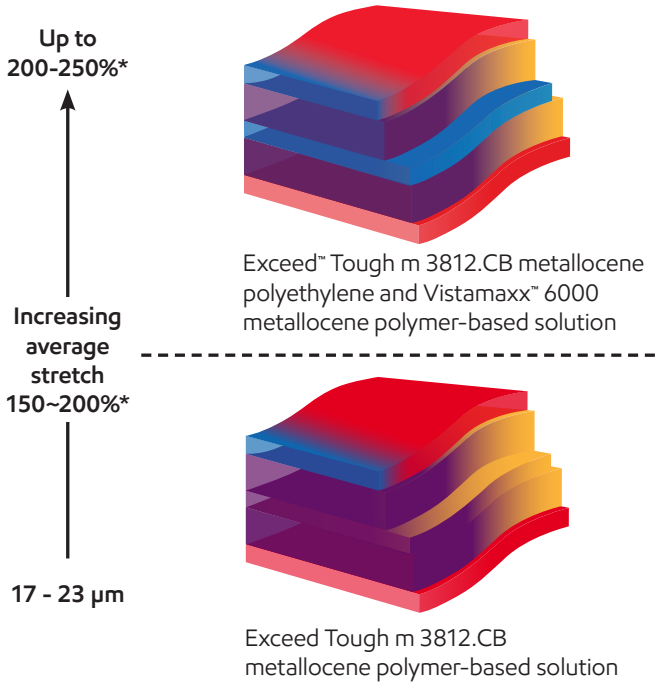
# In summary

**Performance polymer-based Machine Wrap solutions incorporating up to 30% PCR**




ExxonMobil performance polymer-based solutions incorporating up to 30% PCR can:

- Reduce impacts from gels
- Improve wrapper consistency

*Depending on PCR quality, extruder and cast line configuration and settings

■ ExxonMobil™ LLDPE cast ■ Vistamaxx™ 6102/6202 ■ Exceed Tough m 3812.CB ■ Vistamaxx 6000 ■ PCR

| Test item | Test method |
|---|---|
| Ultimate strain | FPT-750 equipment: 30 N unwind force, -4% wind strain, 4000 mm/s line velocity, W stretch pattern |
| Gel count (by consistency test) | 50 m of unstretched film on FPT-750 equipment: 30 N unwind force, 0% pre-stretch, 5% wind strain, 4000 mm/s line velocity, W stretch pattern, gray value 140 |
| Wrapper consistency | 50 m of unstretched film on FPT-750 equipment: 30 N unwind force, 5% wind strain, W-stretch pattern.<br>Wrapper velocity of 50 wraps/min at 100% 150%, 200%, or 250% pre-stretch;<br>3 times no film break is seen as a successful test |
| Melt index | (190°C / 2.16 kg) – based on ASTM D1238 |
| Density / specific gravity | Based on ASTM D792 |

All data in this document have been tested by or on behalf of ExxonMobil

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™ 3812 CB | Exceed™ Tough m 3812.CB |

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**