



2024 FlexPack PLACE Conference

April 14-17, 2024 • San Diego, CA • Wyndham San Diego Bayside



Closing the Loop While Closing Performance Gaps:

Advancements in Mono-material, Multilayer Film Solutions

Michelle Tsui

Associate Technical Service & Development Scientist
The Dow Chemical Company

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Consumers are driving global brands' sustainability goals

Most companies are focusing on:

- Increasing recyclability of their packaging
- Incorporating more PCR/recycled content in packaging

	Brand owners													Retailers		Converters			
			DIAGEO			L'ORÉAL	MARS												
Single-use to reusable	•	•	•	•		•	•	•	•	•	•	•	•		•	•		•	•
Eliminate unnecessary plastic packaging	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•
100% recyclable, reusable, compostable	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
PCR content	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•
Increase recycle rates	•	•	•			•	•		•	•	•	•	•	•					•
Downgauging						•			•							•			•
Bio-source/based		•				•													

400+ signatories to the Ellen MacArthur Foundation's New Plastics Economy

Source: Ellen MacArthur Foundation's New plastics economy
<https://www.foodpackagingforum.org/news/npe-launches-first-global-commitment-report>

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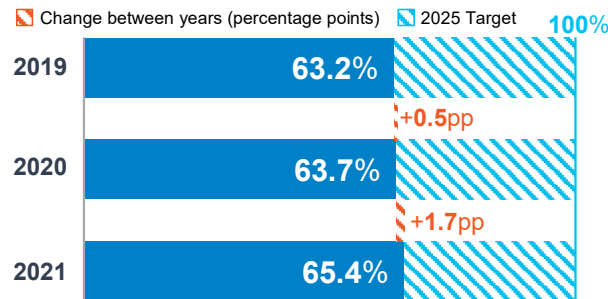


But the progress is not keeping pace with goals

“While strong progress is being made in some areas, key 2025 targets are expected to be missed.”

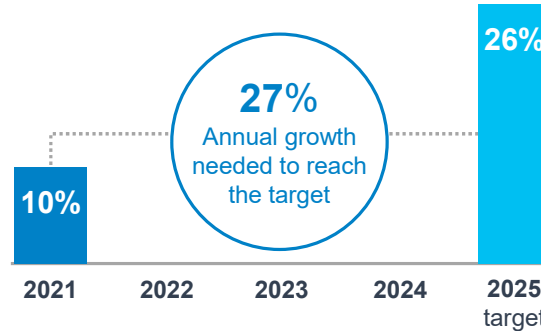
1 Ensure 100% of plastic packaging is reusable, recyclable, or compostable

Percentage (or total weight) of brand and retail signatories' plastic packaging that is reusable, recyclable, or compostable (RRC)



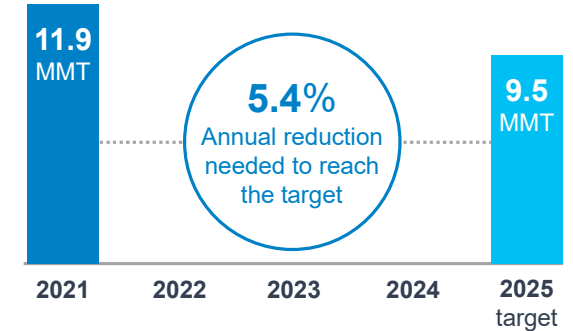
2 Increase the share of post-consumer recycled content target across all plastic packaging used

Percentage (or total weight) of post-consumer recycled (PRC) content in brand and retail signatories' plastic packaging



3 Decrease the use of virgin plastic in packaging

Weight of brand and retail signatories' virgin plastic packaging in metric tons (MMT)



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Actively pursuing circularity while lowering value chain CO₂ emissions

CARBON FOOTPRINT

Design for Recyclability

Mechanical Recycling

REVOLOOP™ product line
Application development for recycled materials. Primary materials boosting performance in application containing PCR

Advanced Recycling

Multi-generational plan consisting of partnerships and in-house technology advantaged solutions

Bio-based Feedstock

Bio-based products to address increasing demand for renewable plastics that reduce carbon footprint without compromising performance

Decarbonization of Assets

Carbon Neutrality by 2050
Net-Zero by 2050
Carbon neutral cracker construction in scope 1 and 2 announced in 2021

Revoloop
recycled plastics resins by 

Affinity CIR
polyolefin elastomers by 

Retain
polymer modifier by 

LDPE REN
low density polyethylene resins by 

Innate
precision packaging resins by 

Elite CIR
advanced polyethylene resins by 

Dowlex CIR
polyethylene resins by 

Affinity REN
polyolefin elastomers by 

Elite
enhanced polyethylene resins by 

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Designing for Recyclability: Mono-material, multi-layer film solutions



The Association of
Plastics Recyclers

Sustainable
Packaging Coalition

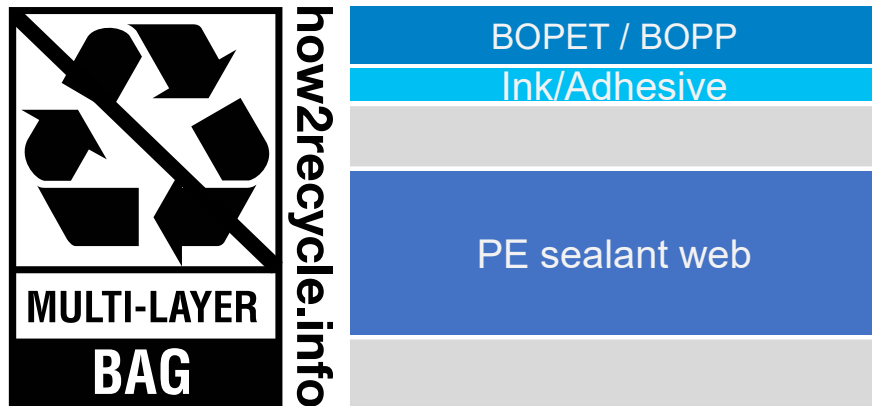
How2Recycle



Most flexible packaging must be redesigned for recyclability

Multiple layers remain, but need to be converted to predominately polyethylene to be eligible for recycling using the store drop-off collection method.

Non-recyclable Structure (Multi-material)

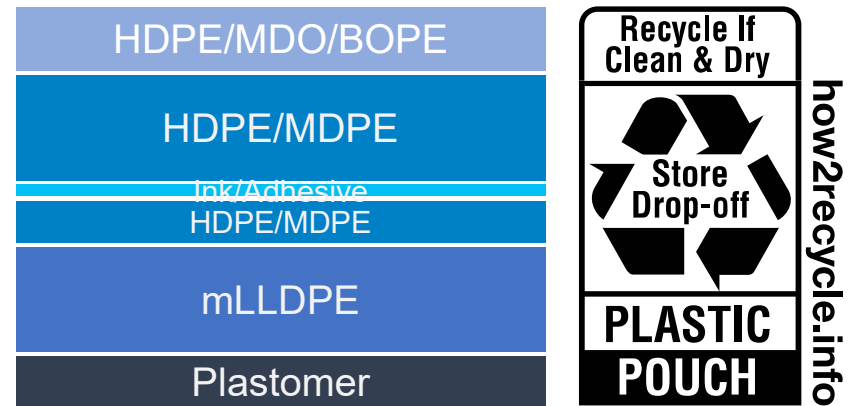


E.g., PP, PET, PVDC, PE PVC,
Aluminum foil, EVOH

Redesign



Recyclable Structure (Mono-material all PE)





Sustainability brings new challenges to packaging

The **machinability** of mono-material PE films needs to be optimized to broaden the **packaging window**.

Film Machinability:

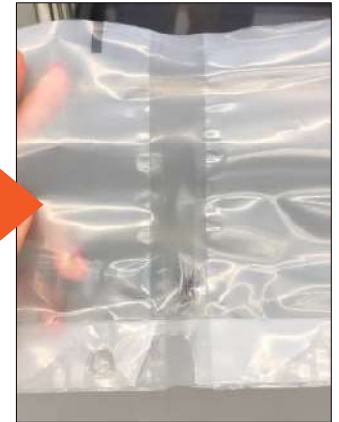
- Film integrity during pouch conversion →
- Tension, friction, heat sealing

Packaging window:

- Range of sealing temperatures and bag speeds where *quality*, *hermetic pouch* can be produced

PE ≠ Drop-in for
PP, PET, nylon, etc.

Lower melting point,
reduced stiffness



Stretching, melting, sticking to seal bars, shrinking

Narrow packaging window:

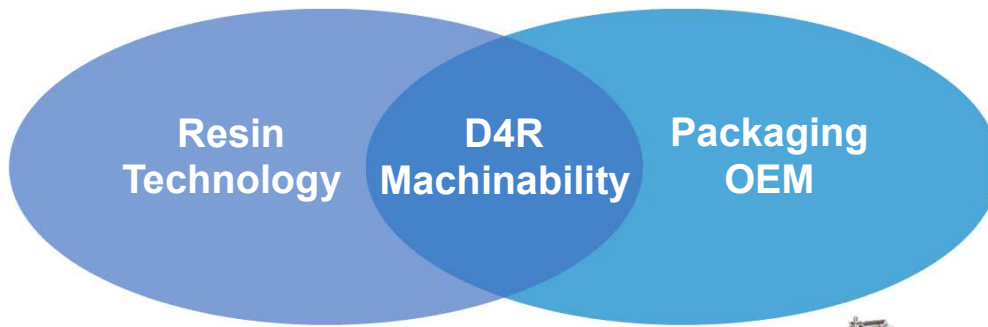
- 20-50% slower production speed
- E.g., More pouch failures, scrap, etc.
- Increased Cost \$\$\$

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Collaboration through the value chain to enable success



We need to work together to prove that packaging can be **high performance AND recyclable**

mespack
A DURAVANT COMPANY



An innovative stand-up pouch, HFFS line to run All-PE Films:

- Triple point sealer
- Spout pre-heating
- Precision temperature control seal bars
- Film tension controller
- Cooling station

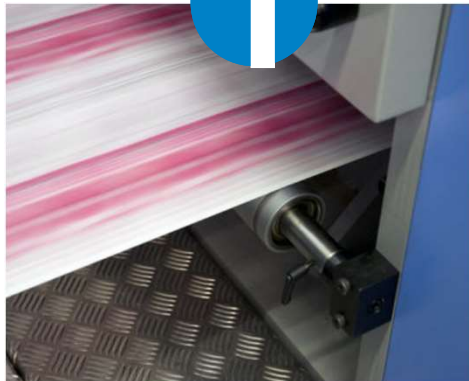
Located at Dow Pack Studios, Freeport, TX



Optimizing All-PE Films and Designing for Recyclability (D4R)

Maximize the operating packaging window by...

1



Pairing the right resins
with the right equipment
technologies

2



Optimizing film design for
improved machinability



1. Pairing the right resins with the right equipment technologies

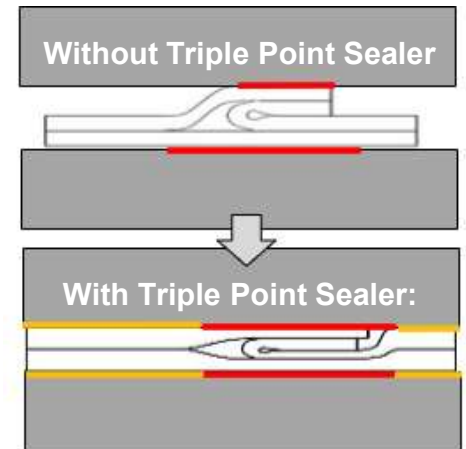
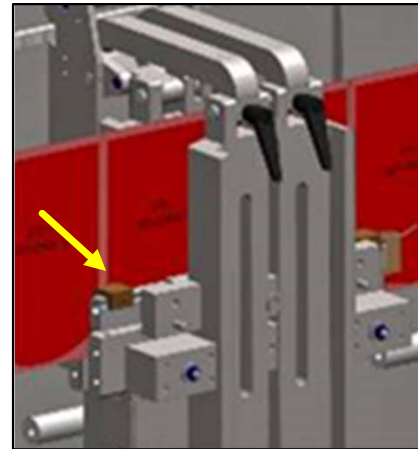
Post-metallocene LLDPE resins from Dow and HDPE resins – High-performance stiffness and toughness resins



Plastomer resins from Dow
High sealing performance at lower temperatures

Mespack Triple Point Sealer:

- Additional sealing station
- Localized sealing at triple point/gusset
- Reduces film stretching and sticking of overall film.

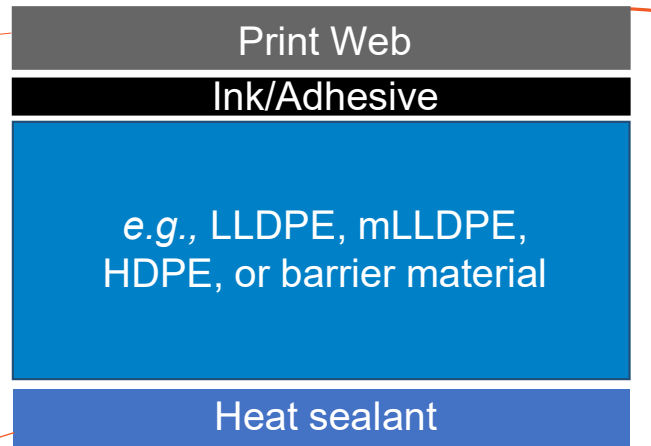




2. Optimizing film design for improved machinability

Design Parameters Evaluated

MDO-PE Print Web

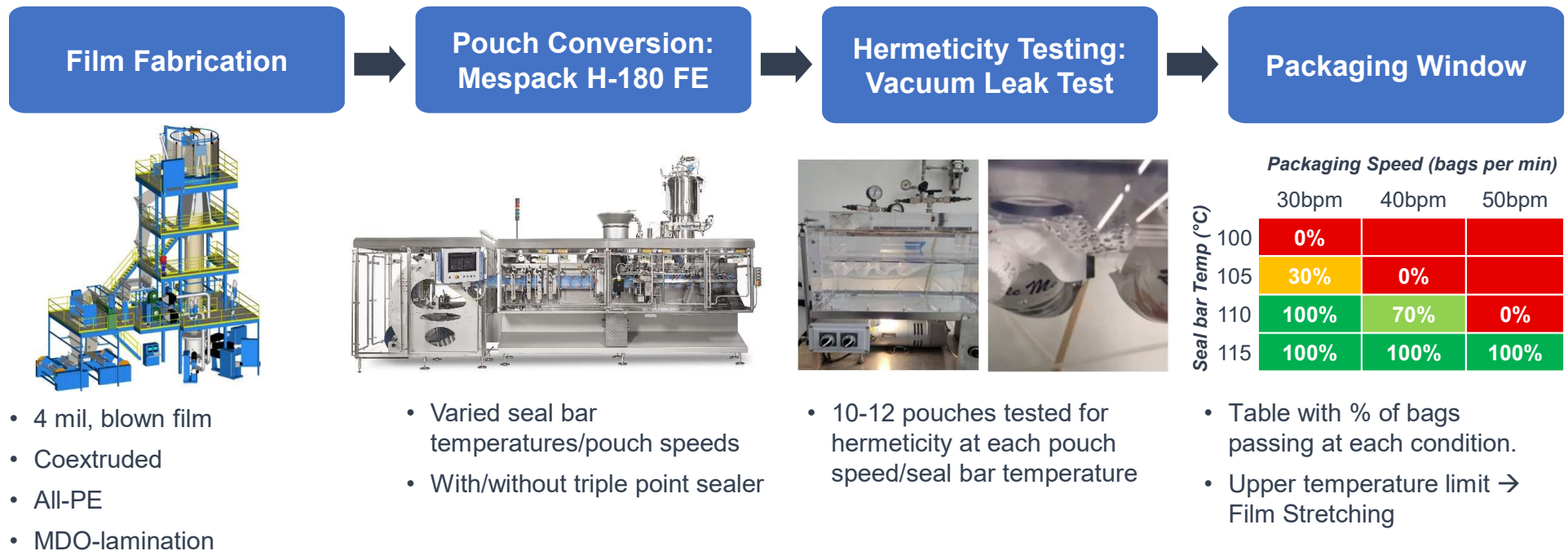


**Film Stiffness
Film Thickness**

**Sealant Density
Sealant MFI**



Methodology

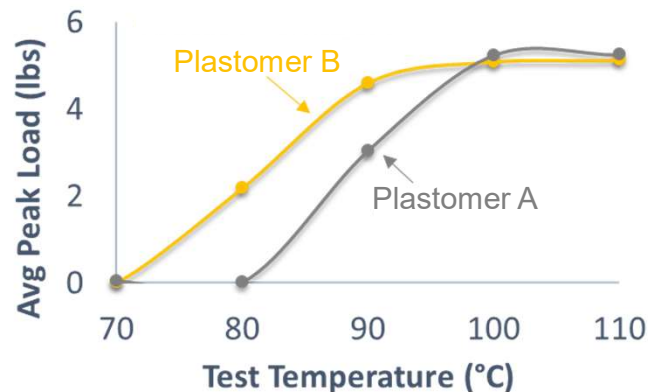
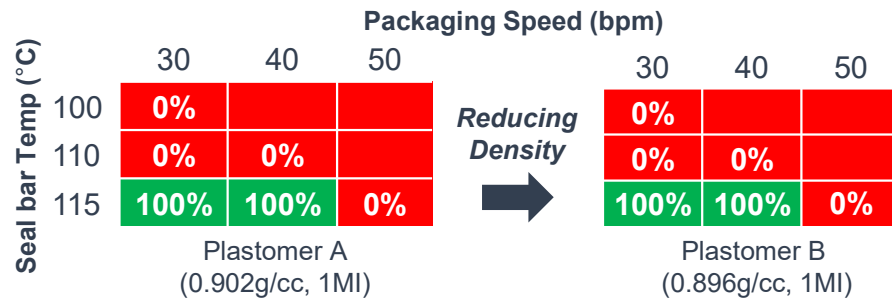




Effect of sealant density on packaging window

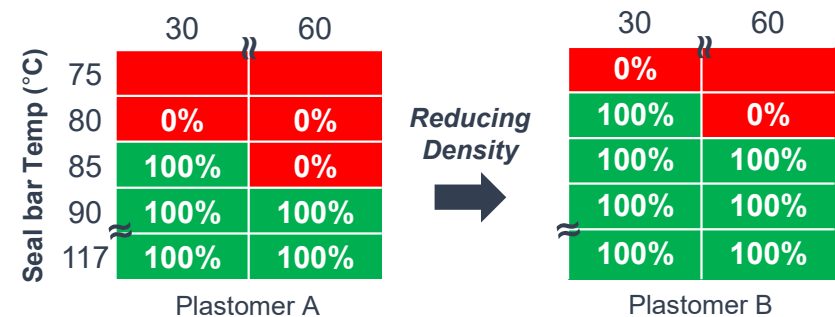
Without Triple Point Sealer

Reducing sealant density → No improvement



With Triple Point Sealer

- Significant expansion in packaging window
- 5C expansion with reduced density.



Without Triple point sealer:

- Packaging Window: 5°C
- Hermeticity *does not* correspond to reduced HSIT

With the triple point sealer:

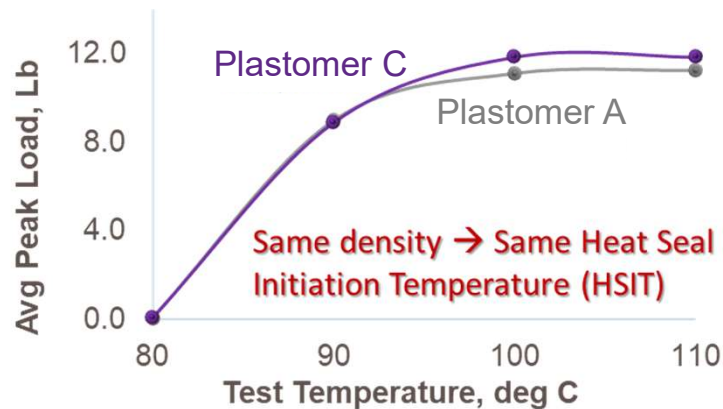
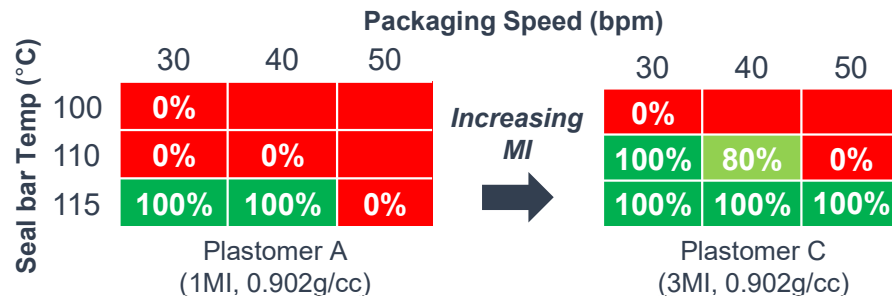
- Packaging Window: 27–37°C
- Hermeticity corresponds to reduced HSIT



Effect of melt index on packaging window

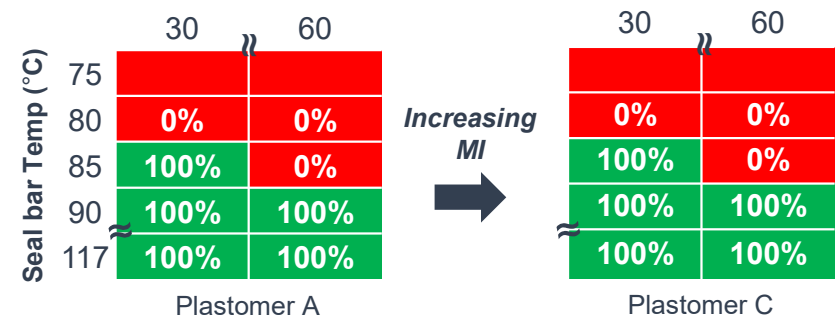
Without Triple Point Sealer

Increasing sealant MI → Expands packaging window



With Triple Point Sealer

- Significantly expanded packaging window.
- MI has no further impact.



Without Triple point sealer:

- Packaging Window: 5–10°C
- Higher MI → Faster flow to fill channel quickly. Effect cannot be observed with heat seal strength test. Geometry effect.

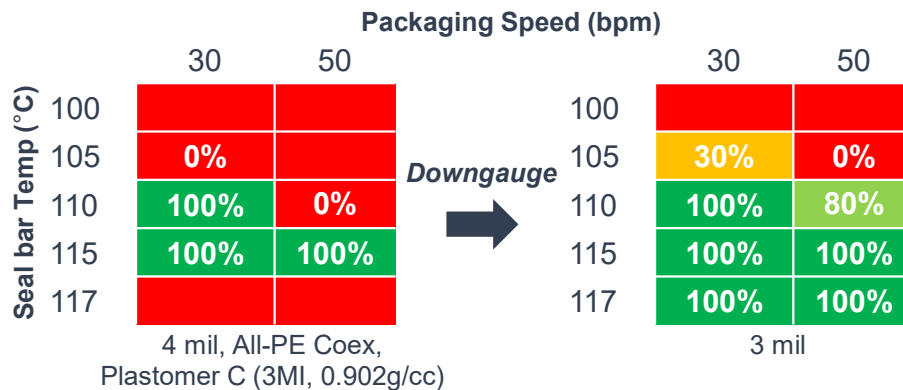
With triple point sealer:

- Packaging Window: 27–32°C
- Sealant performance corresponds to HSIT



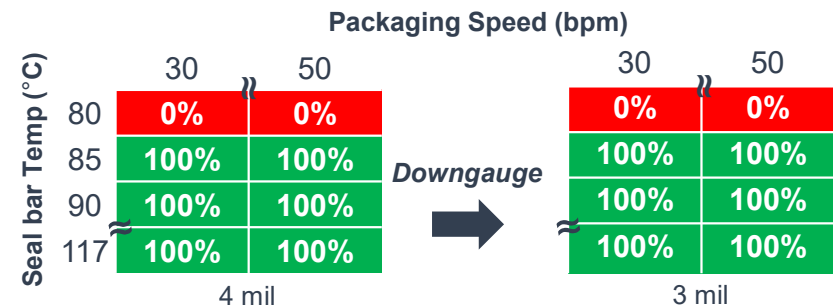
Effect of film thickness on packaging window

Without Triple Point Sealer



- Thinner gauge improves packaging window.
- Thinner gauge reduces pressure difference from 2 to 4-ply region.

With Triple Point Sealer



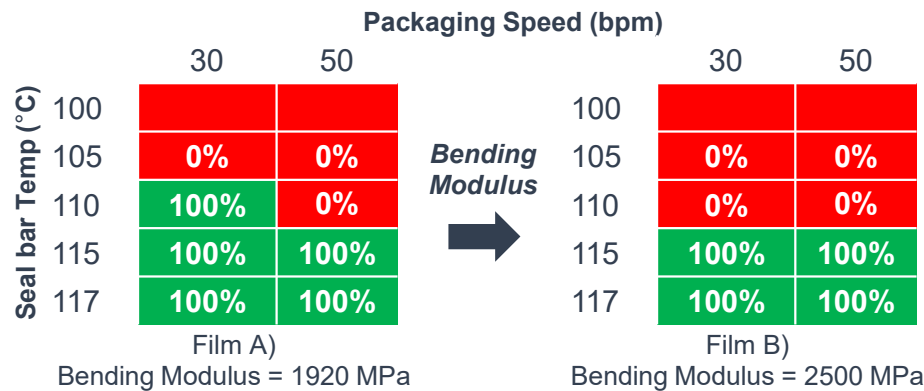
- Thinner gauge does not further improve packaging window.
- Triple point sealer eliminates sealing pressure difference from 2 to 4-ply region.

Downgauging by 25% from 4 mil to 3 mil led to ~5°C expansion in packaging window

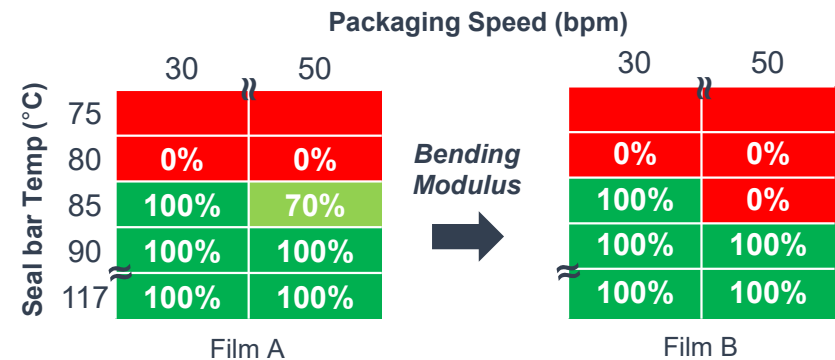


Effect of film stiffness on packaging window

Without Triple Point Sealer



With Triple Point Sealer



Post-metallocene
LLDPE / HDPE

Plastomer

Rearranged order of HDPE and post-metallocene LLDPE layers to increase bending modulus of film

Without Triple point sealer: Stiffer film leads to greater spring-back forces at triple point and reduces hermeticity

With triple point sealer: Similar trend but stiffer film has reduced impact

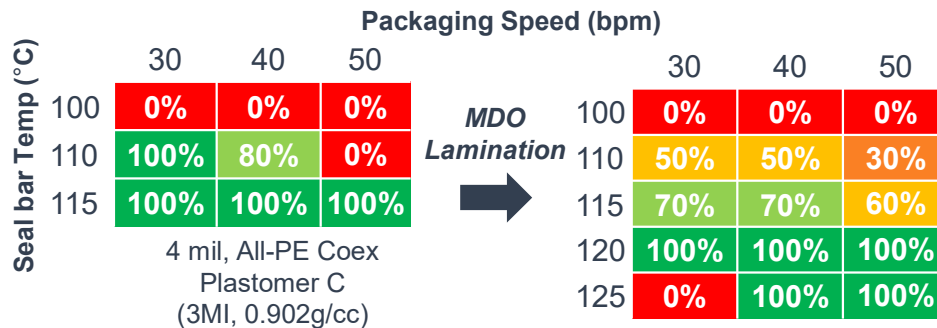
Increasing Bending Modulus by 30% can reduce packaging window by ~5°C



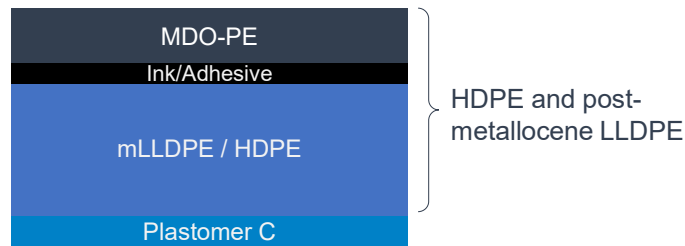
Effect of MDO print web on packaging window

Without Triple Point Sealer

MDO lamination → Shifts packaging window to higher temperature by ~5°C without film stretching issues

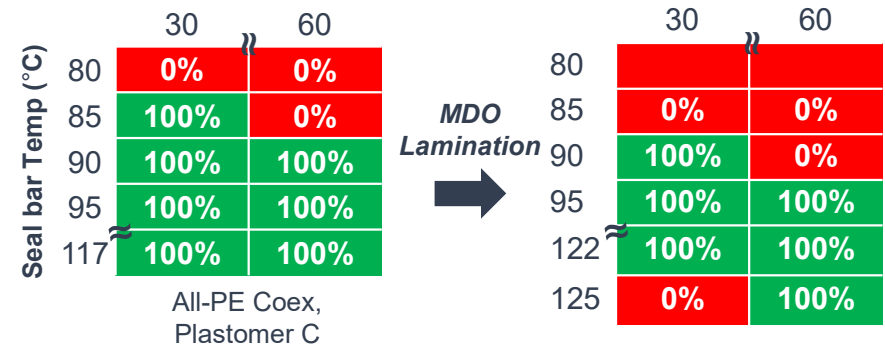


HDPE and post-metallocene LLDPE from Dow for stiffness and optics in MDO films



With Triple Point Sealer

- Significantly expanded packaging window.
- MDO Lamination shifts packaging window to higher temperatures by ~5–10°C.

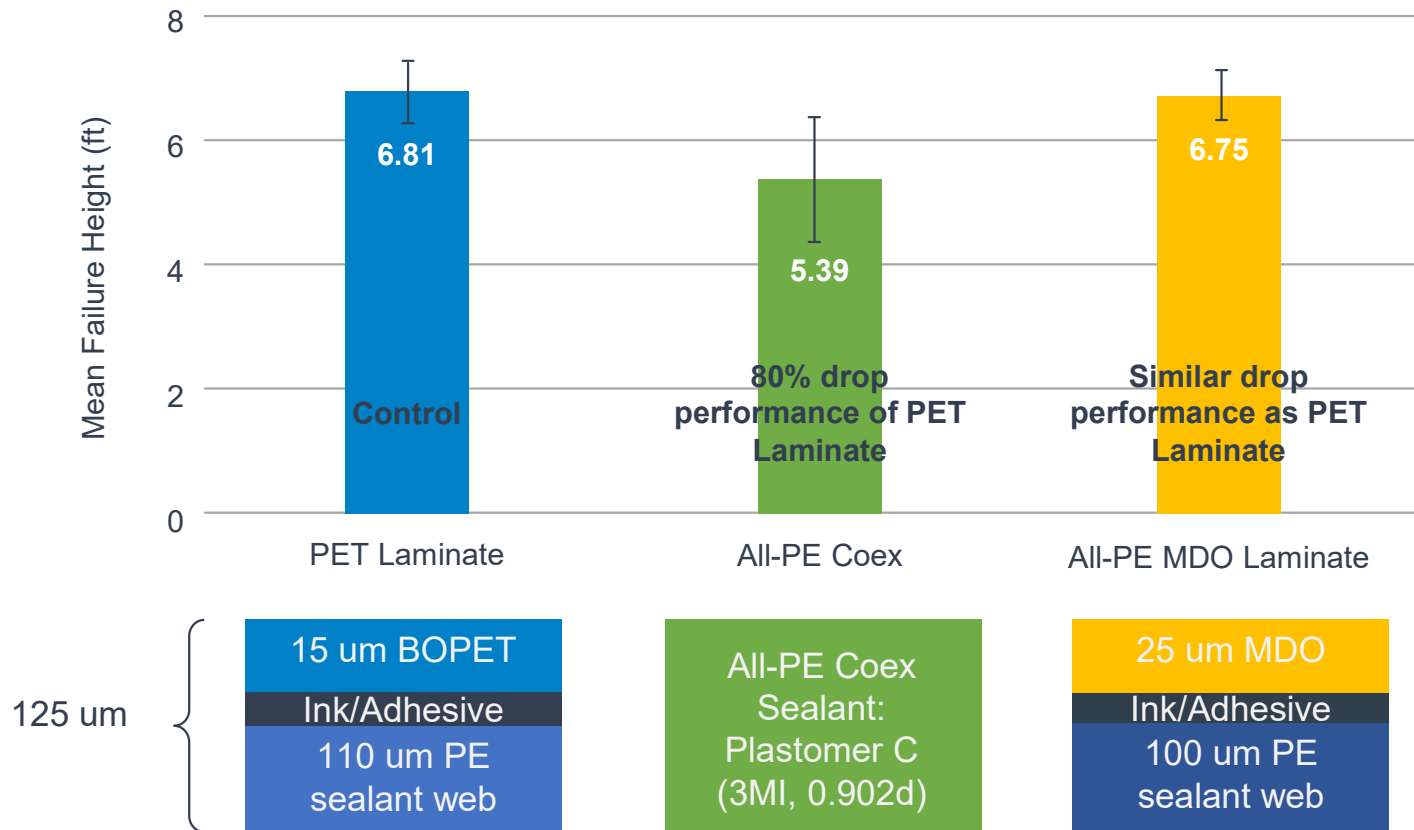


Without Triple point sealer:
Packaging Window: 5–10°C

With triple point sealer:
Packaging Window: 30–32°C



Drop performance comparison





Closing the gap in performance

- **All-PE design guidelines with AFFINITY™ Polyolefin Plastomer Sealants:**
 - **Without triple point sealer** – Plastomer with higher MI provides the best packaging window for all-PE pouches
 - **With triple point sealer** – Plastomer with lower density provides the best packaging window
- **Combining high-performance resins, advanced film fabrication technology, and innovative stand-up pouch making machine, it was shown that All-PE films can...**
 - Have packaging windows between 27–37°C similar-to PET-laminate films at reasonable pouch speeds 30–60bpm → Increase pouch converting efficiency.
 - Achieve improved 1) dimensional stability at higher temperature and 2) end-use package performance (e.g., drop performance) with HDPE and post-metallocene LLDPE.

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Acknowledgments

Special thank you to...

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CONTACT INFORMATION:

Michelle Tsui

The Dow Chemical Company

mtsui1@dow.com