



**Your Partner
in Polymer Compounding
and Additive Blends**





Overview



	Characteristics & Details
Raw Material	Liquid PIB agent in LLDPE carrier
Form	Dried & non sticky pellet
Effect	Delivers PEEL & LAP Cling Strengths for LLDPE Films Increases COF between two surface layers
Grades	PW 60 – Designed for Balanced PEEL / LAP Strength properties & Long/Short Migration Time PW 70 – Designed for LAP Strength Properties & Short Migration Time

Benefits



Food Contact
Approved



Excellent Cling
Properties



Ease of dosing of High amount
of PIB content in pellet form



Processing Aid Effect



Final Mechanical &
Optical Properties
preserved or improved



Consultancy Approach with
25+ Years of experience as
market leader

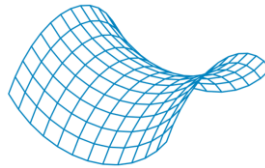




Material &
Application profile

Resin Compatibility: **LLDPE, LDPE**

Processing mode: **Blown & Cast Films**



Effects brought

Different effect wished from end-markets:

**High Lap Cling
Strenght**

**High Peel
Cling Strenght**



Markets & End
Applications



Pallet stretch film /
Power stretch wrap



Food stretch film /
Hand wrap films



Silage stretch film /
Silage wrap film



Grade PW70

2 to 6%

Grade PW60

Up to 15%



*PE Stretch Films – Polytechs
pathway to handle cling effect*



To cling

To hold itself onto a surface in a reversible way thanks to a « cling » strength property.

Cling strength

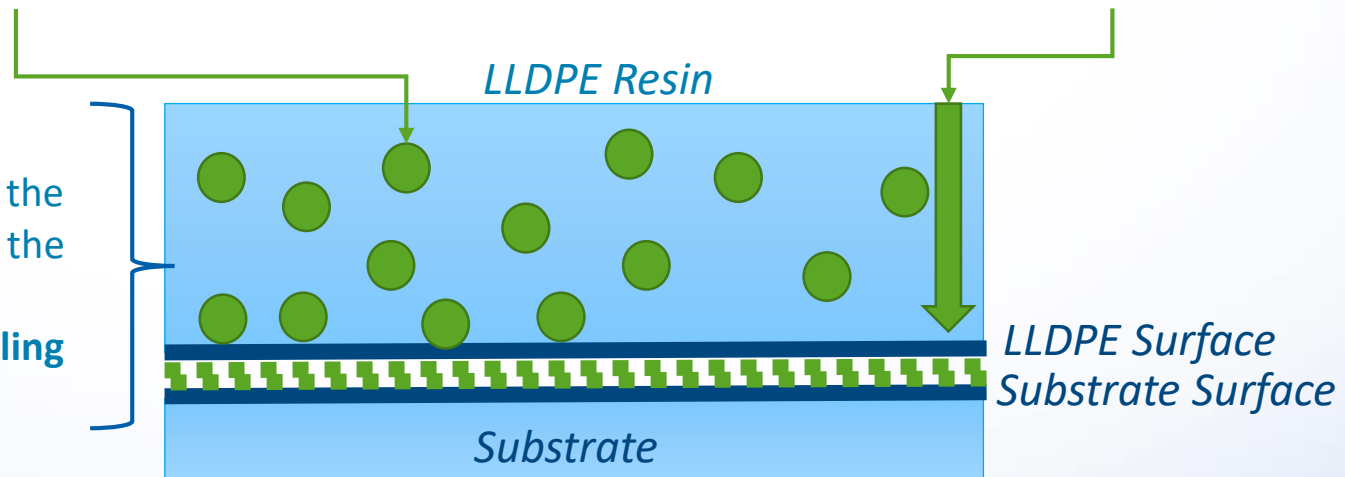
Unit measure specified for two effects : Peel Cling & Lap Cling

Cling agent: material enhancing cling strength. Can ensure maintaining or improving other properties (processing, mechanical properties, etc.)

Cling development: Time to achieve the maximum cling strength

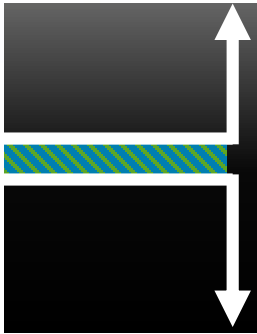
Film cling properties:

- **Cling Strength** brought by the combination of the resin & the cling agent
- **Migration time of the Cling Agent**



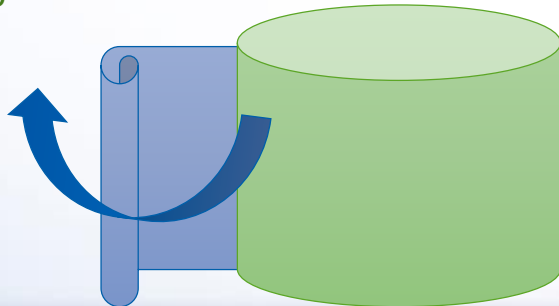


PEEL Strength

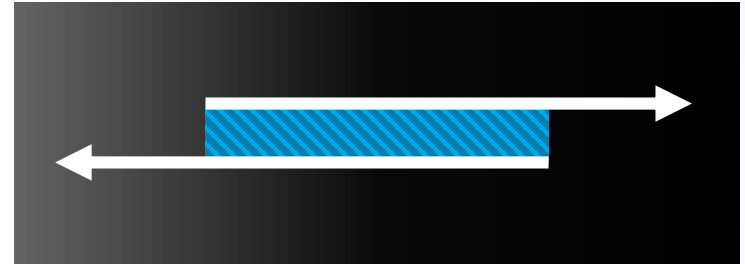


High peel cling will prevent unwrapping of the film by friction

Example: Film applied on Silage Ball need Peel Strength

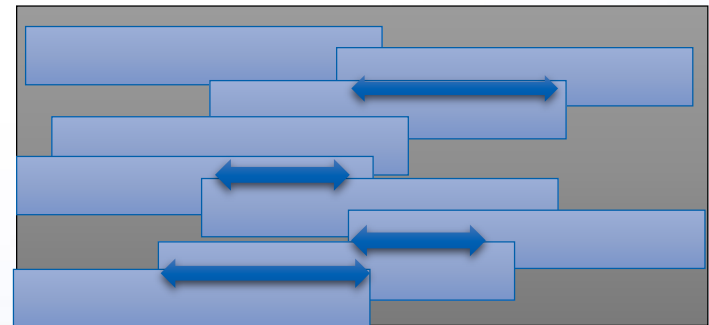


LAP Strength



High lap cling will ensure good interlayer cohesion to the benefit of the holding force and airtight

Example: Film applied on Pallet need Lap Strength

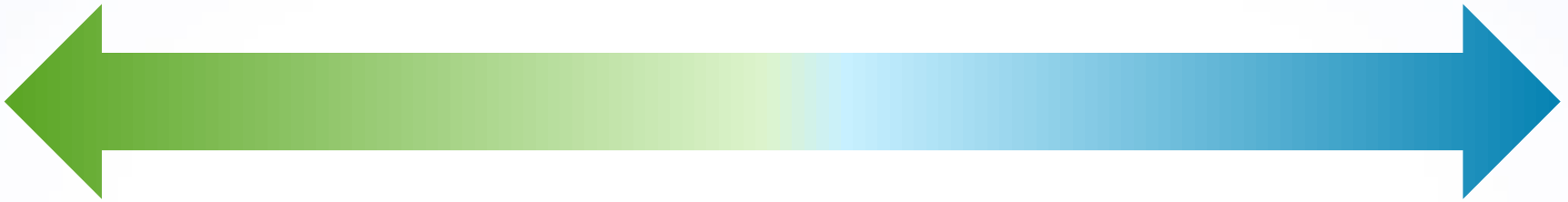
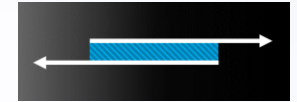




PEEL

Strength

LAP Strength



High Peel Strength

High Lap Strength

Longer Migration Time on surface layer

Shorter Migration Time on surface layer

Higher Unwinding Noise

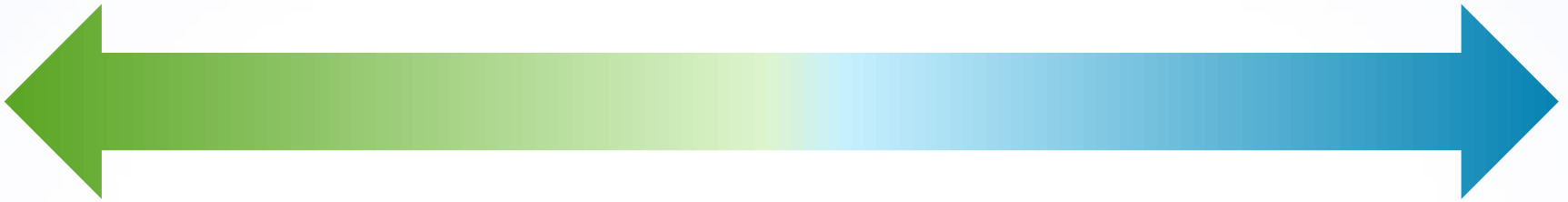
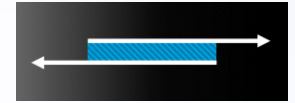
Lower Unwinding Noise

Less « greasy effect » on surface

More « greasy effect » on surface



LAP Strength



 **PW 60**

- Long Term / Peel Strength & Short Term / Lap Strength combination
- 60% of Liquid PIB inside pellet

 **PW 70**

- Short Term / Lap Strength combination
- 70% of Liquid PIB inside pellet



*PE Stretch Films – Market
applications & Polytechs pathway*



Market Profile (cast & blown)

- **1,2 MT** of PE used for stretch films
- CAGR of **4.5%**
- 71% Cast Films & **29% Blown Films**
- **76%** multi-layer films vs **24%** mono-layer films
- Mostly **LLDPE-C8 ; m-LLDPE & SuperHexene-LLDPE**

Key technology attributes in constant improvement

- Enhanced **stretching performance**
- **Stiffness**
- Superior **cling properties**
- Lower **thickness**
- Enhanced **toughness**



Liquid PIB in direct injection

Liquid PIB in masterbatch form

Polyolefin elastomer

Most important cling agents in use for blown films:





1

End Application

2

Cast vs Blown

Number of Lines

Number of Layers

End Application	Silage Wrapping				Pallet Wrapping & Food Wrapping			
Process Method	Blown		Cast		Blown		Cast	
Line Type & Layer Number	X lines Mono	Y lines Multi	X lines Mono	Y lines Multi	X lines Mono	Y lines Multi	X lines Mono	Y lines Multi
Grade to consider	PW 60 → Balance PEEL / LAP Strength				PW 70 → Fast Migration & high LAP Strength			
Critical Parameter	Winding Tension & Storage T° of Films to prepare Seasons				<ul style="list-style-type: none"> - Resin density in MultiLayer Films - Heating system or 2 days @ High storage T° for immediate sale 			
PW Percentage	Depending on parameters & effects 6 to 12%				Depending on parameters & effects 1 to 6%			



*In PE Stretch Films – Technical data
for PE BLOWN STRETCH FILMS*



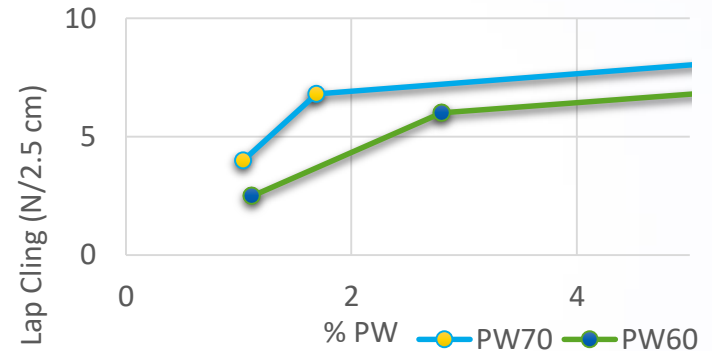
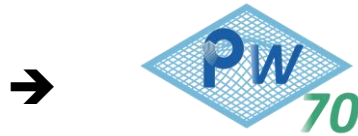
Pallet stretch film



Food stretch film

Application profiles

- 20 to 25 μm film thickness
- 3 to 7 layer coextruded structures
- Strong Lap cling strength properties
- Good transparency & Puncture resistance



Formulation starter guide

Typical Dosing

Process	Film Structure	PALLET WRAPPING		
		LLDPE + mLLDPE + LDPE	PW70	
Blown	1 layer	82% LLDPE + 12% LDPE	6%	
	2 layers	A	82% LLDPE + 12% LDPE	6%
		B	82% LLDPE + 12% LDPE	6%
	3 layers	A	100% LLDPE (0.930)	X
		B	100% LLDPE (0.918)	X
		C	82% LLDPE + 12% LDPE	6%

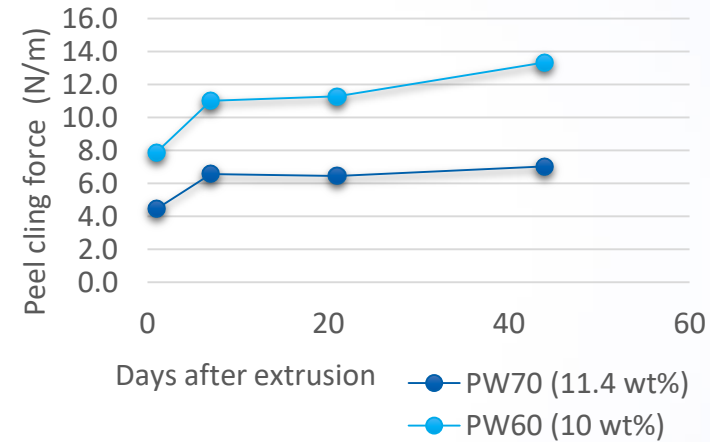
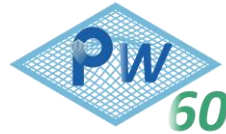
Process	Film Structure	FOOD WRAPPING		
		LLDPE + mLLDPE + LDPE	PW70	
Blown	1 layer	30% LLDPE + 66% LDPE + 2% AF	1-2%	
	2 layers	A	30% LLDPE + 66% LDPE + 2% AF	1-2%
		B	30% LLDPE + 66% LDPE + 2% AF	1-2%
	3 layers	A	30% LLDPE + 66% LDPE + 2% AF	1-2%
		B	50%LLDPE + 50% LDPE	X
		C	30% LLDPE + 66% LDPE + 2% AF	1-2%



Silage stretch film

Application profiles

- 17 to 23 μm film thickness
- 3 & 5 layer coextruded structures
- Strong Peel cling strength properties
- Good Puncture resistance




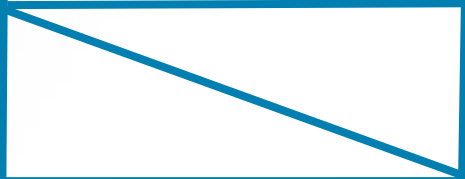




Formulation starter guide

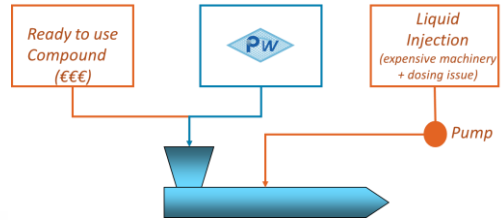
Typical Dosing

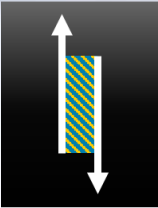
Process	Film Structure	SILAGE WRAPPING		
		LLDPE + mLLDPE + LDPE	PW60	
Blown	1 layer	54% LLDPE + (30% mLLDPE) + 2% UV + 2% TiO2	12%	
	2 layers	A	54% LLDPE + (30% mLLDPE) + 2% UV + 2% TiO2	12%
		B	54% LLDPE + (30% mLLDPE) + 2% UV + 2% TiO2	12%
	3 layers	A	83% LLDPE + 2% UV	15%
		B	91% mLLDPE + 3% TiO2	6%
		C	83% LLDPE + 2% UV	15%



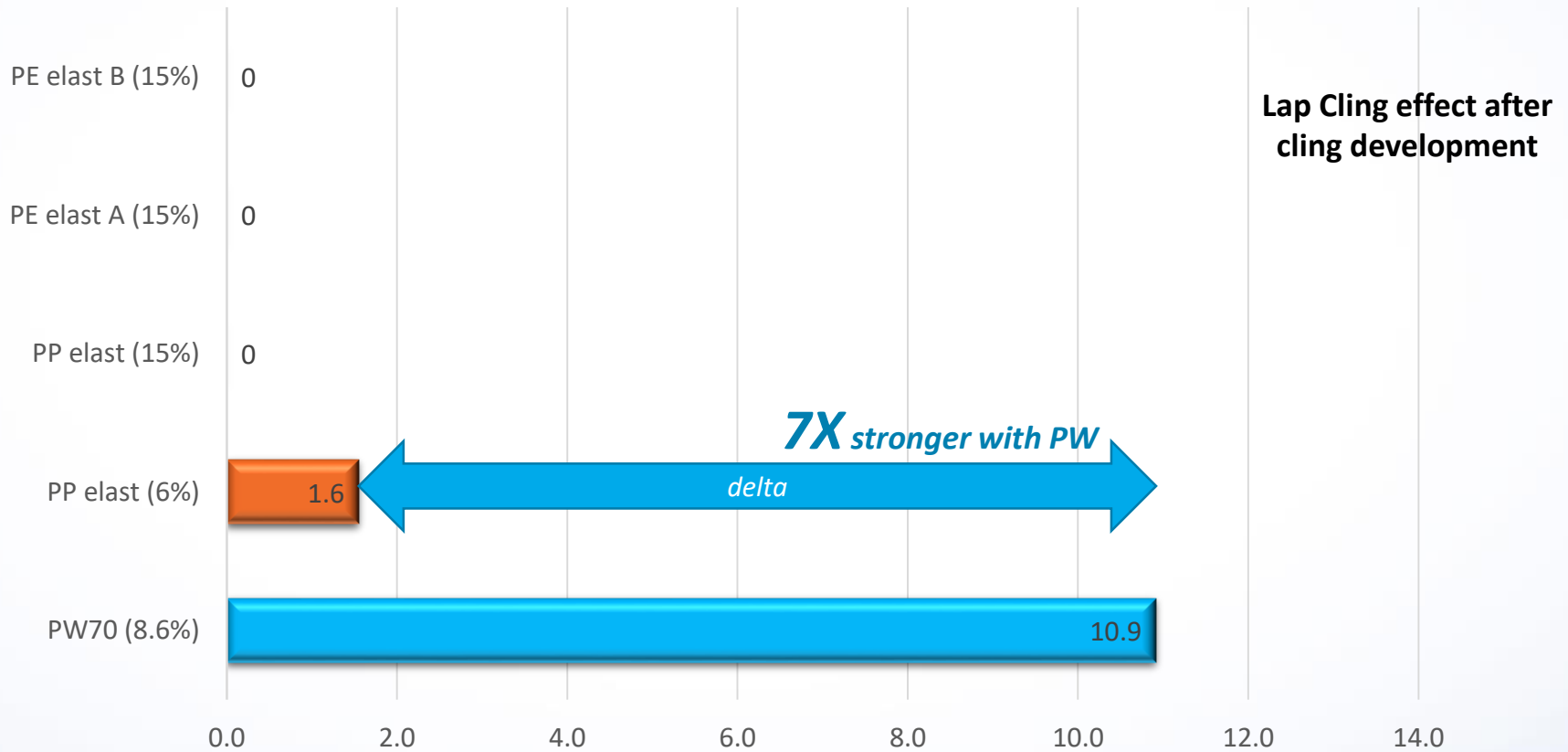
• **Comparison of Cling agents in use for blown films:**

<p>Liquid PIB in direct injection</p>	<p> Liquid PIB in masterbatch form</p>	<p>Polyolefin elastomer</p>
	<p> <ul style="list-style-type: none"> ➔ Higher cling strength ➔ Higher properties recovery ➔ Higher processing advantages </p>	
<p> <ul style="list-style-type: none"> ➔ <u>Flexibility & ability in using different PIB molecular weight</u> ➔ <u>Granulates vs liquid – safer use</u> ➔ <u>Easier form for PIB addition & dosing:</u> </p>		
	<p><u>PW70 vs 70% PIB MB:</u></p> <ul style="list-style-type: none"> • better dispersion resulting in smooth effect • better transparency 	





PW delivers a 7X stronger Lap Cling effect than Polyolefin Elastomers



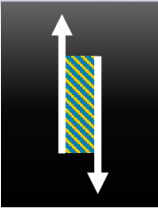
**Lap Cling effect after
clinging development**

7X stronger with PW

delta

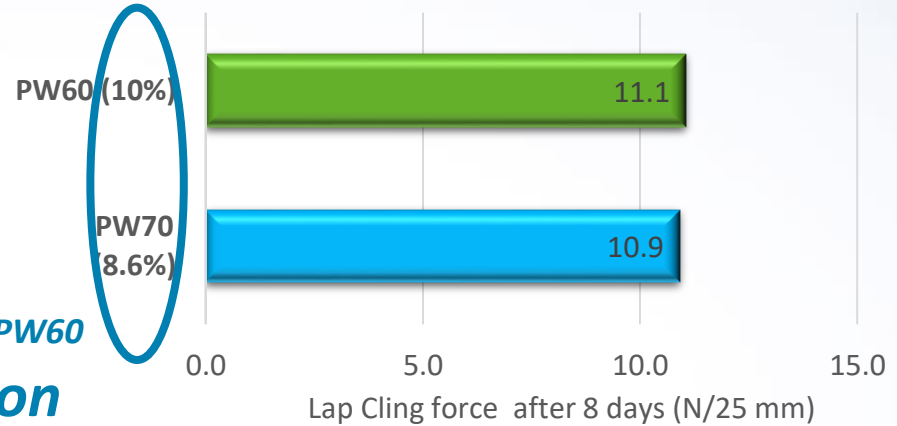
Lap Cling force after 8 days (N/25 mm)

**25µm film, superhexene LDDPE (MI 0.9 & d:918);
220°C ; BUR 2.5, 50 kg/h, Monolayer**



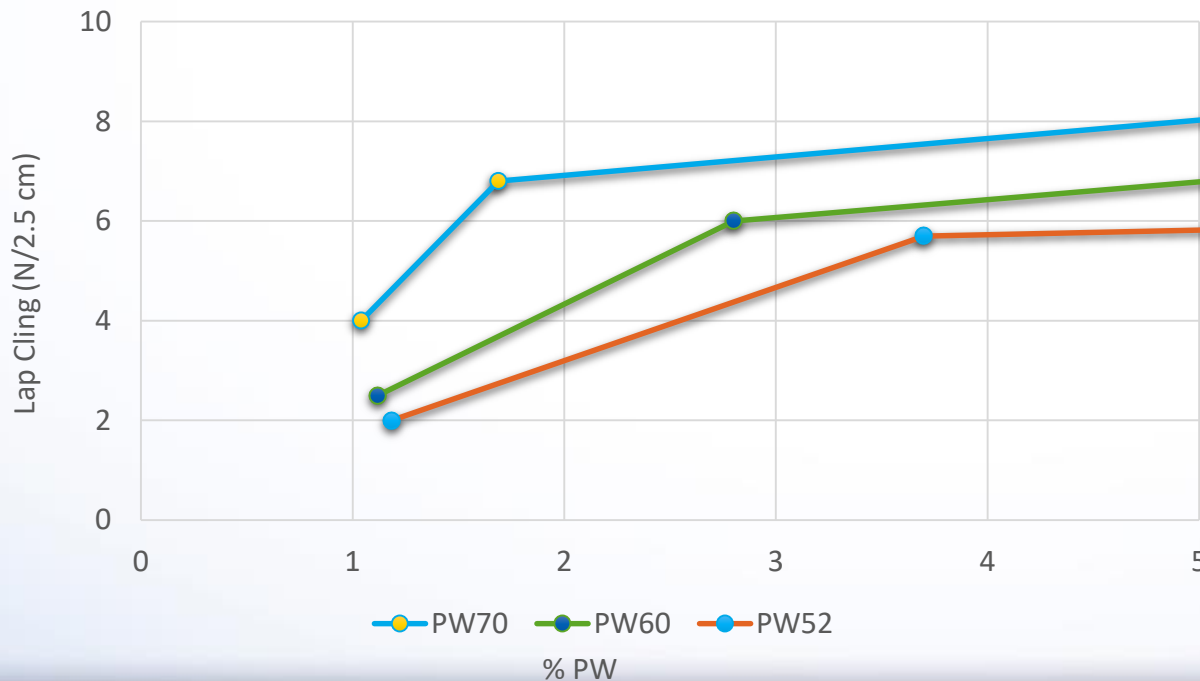
PW70 as the best-in-class Lap Cling solution

*PW70 / Same Lap cling level than PW60
for **16% dosing reduction***



**Lap Cling effect after
cling development**

**PW70 has a 1 to 3X
stronger Lap cling than PW
60 & 52**

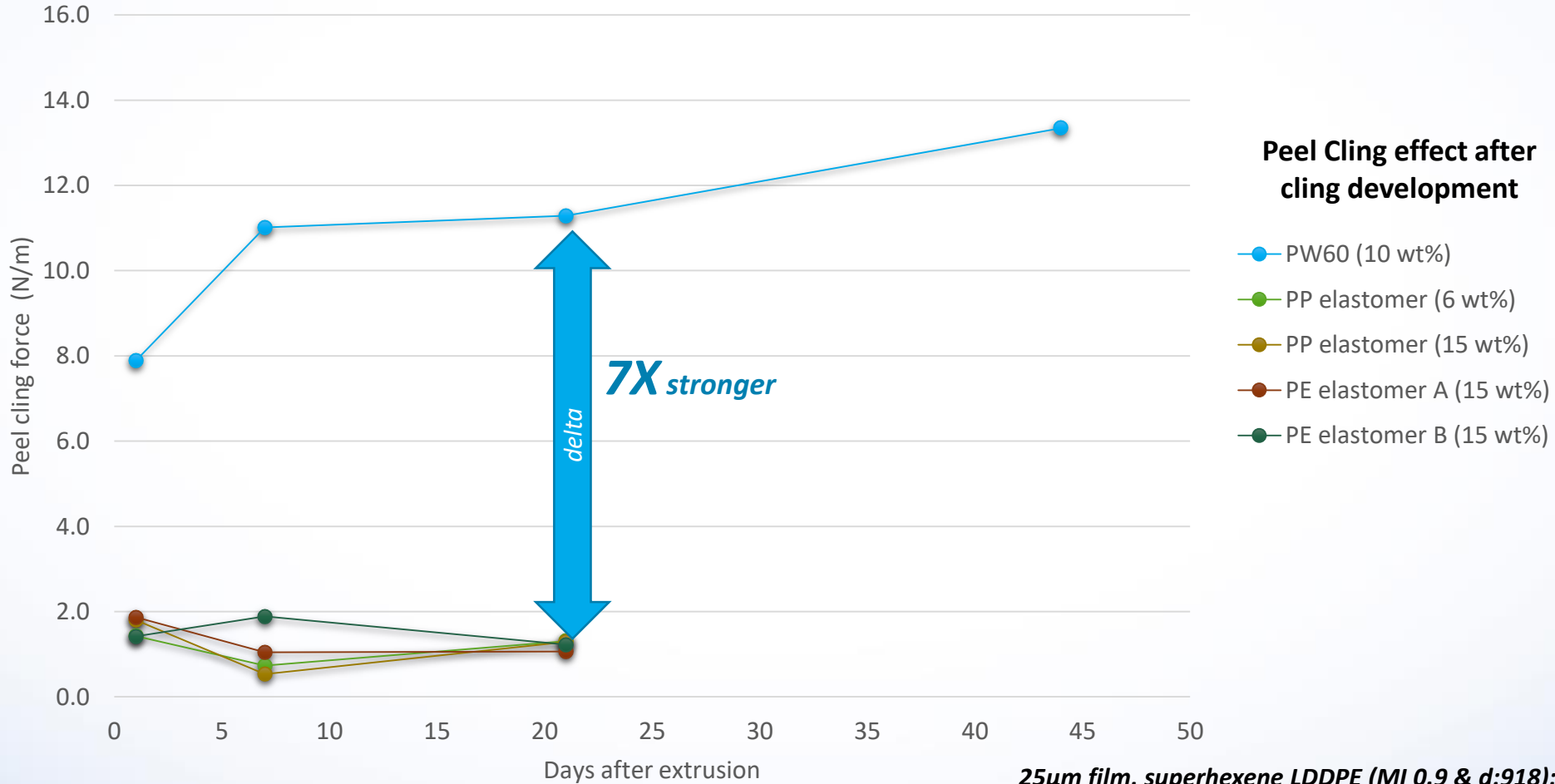


**PW range performance on Lap Cling
effect after cling development**

*25µm blown film, after 7 days conditioning
@23°C, 50%RH*



PW delivers a 7X stronger Peel Cling effect than Polyolefin Elastomers



25µm film, superhexene LDDPE (MI 0.9 & d:918);
220°C ; BUR 2.5, 50 kg/h, Monolayer



PW60 as the best-in-class Peel Cling solution

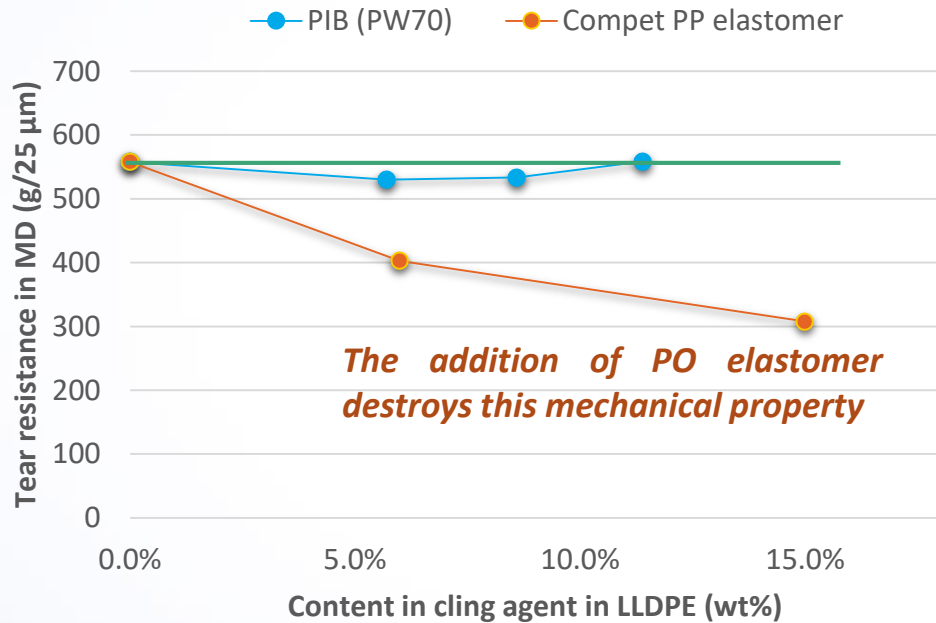


25µm film, superhexene LDDPE (MI 0.9 & d:918);
220°C ; BUR 2.5, 50 kg/h, Monolayer

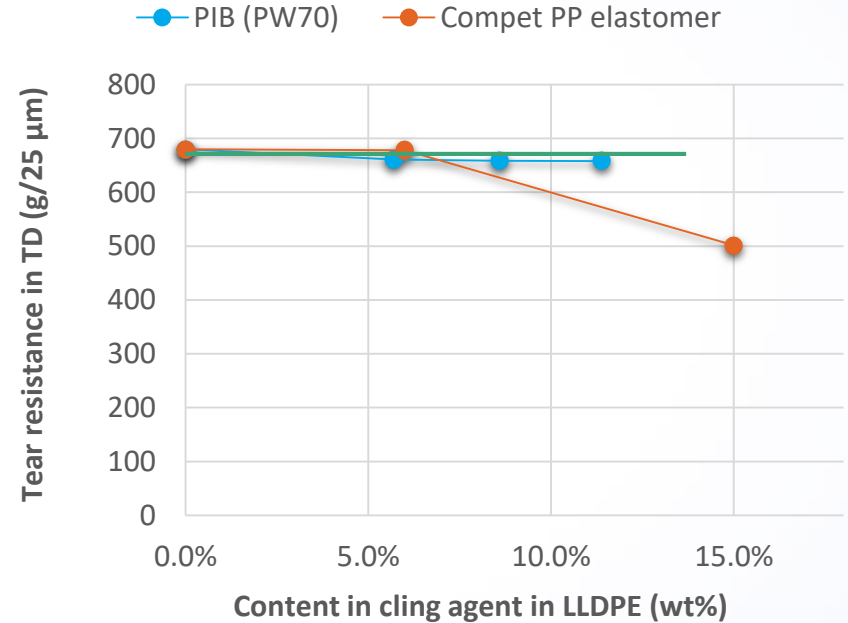


PW range doesn't impact Tear resistance properties

Tear resistance with Machine Direction (MD)



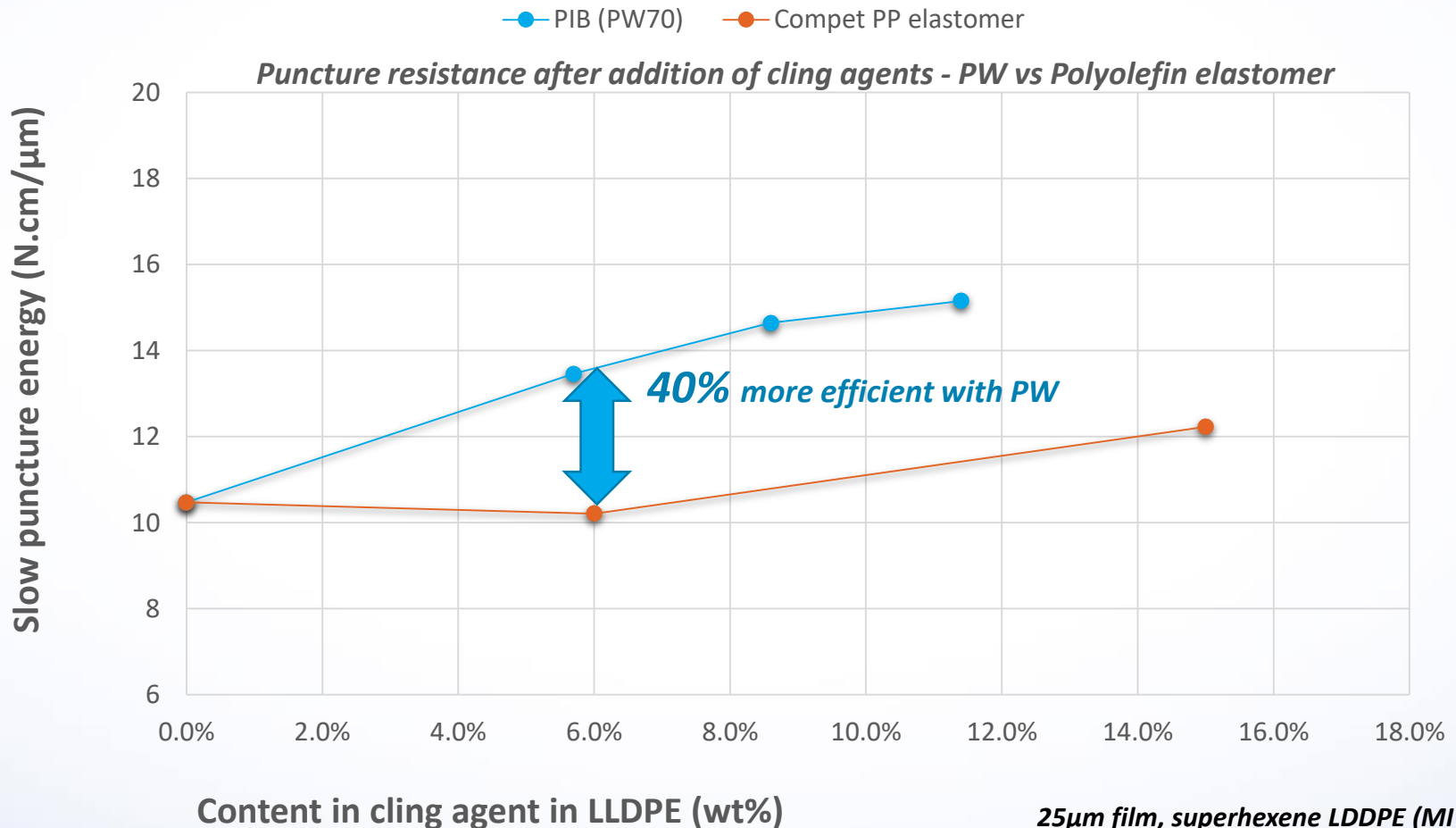
Tear resistance with Transverse Direction (TD)



*Tear resistance after addition of cling agents -
PW vs Polyolefin elastomer*



PW provides a 40% more efficient resistance to puncture than PO elastomers

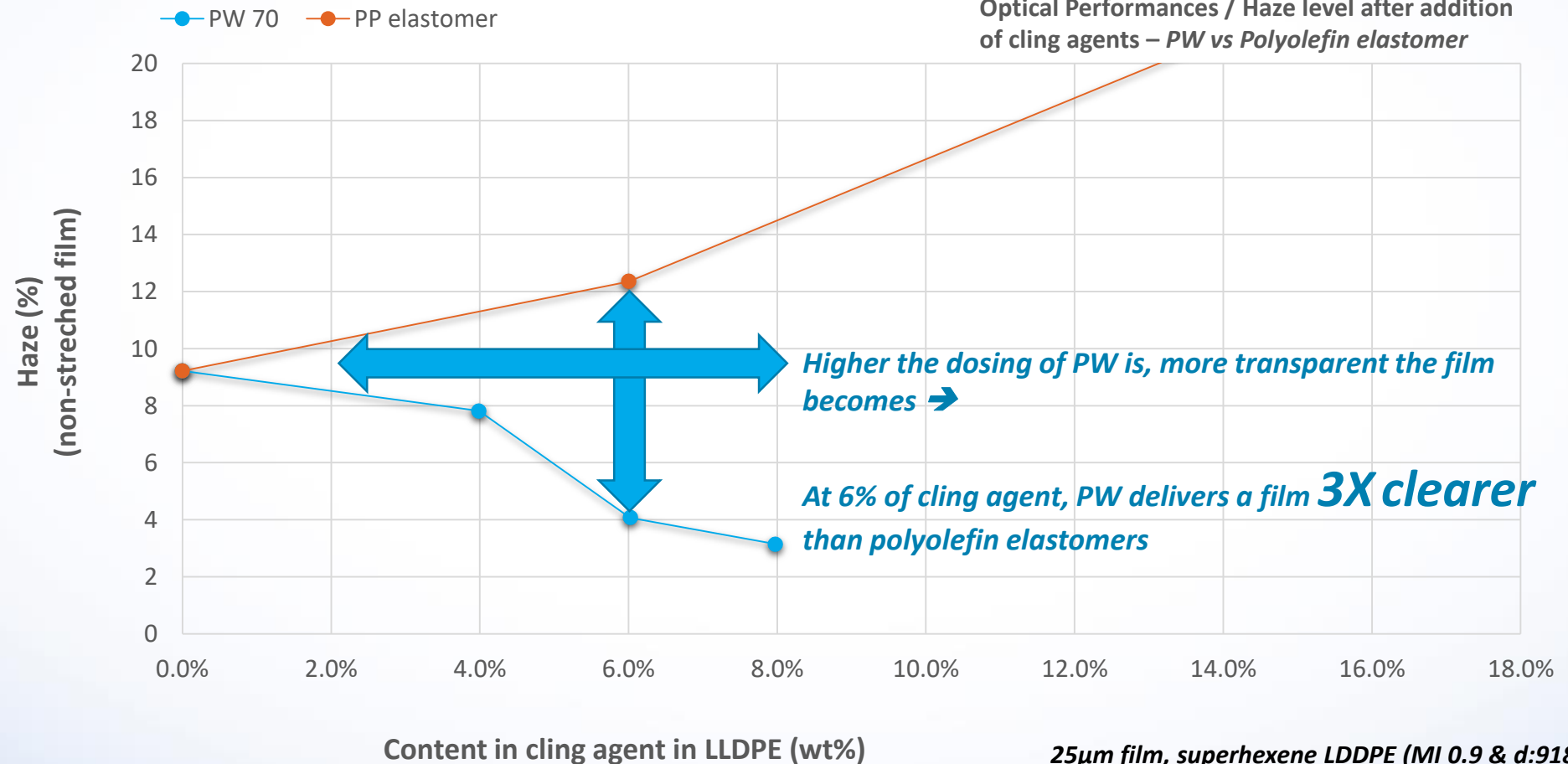


25 μ m film, superhexene LDDPE (MI 0.9 & d:918); 220°C ; BUR 2.5, 50 kg/h, Monolayer



PW improves the film transparency by reducing its haze level

Optical Performances / Haze level after addition of cling agents – PW vs Polyolefin elastomer



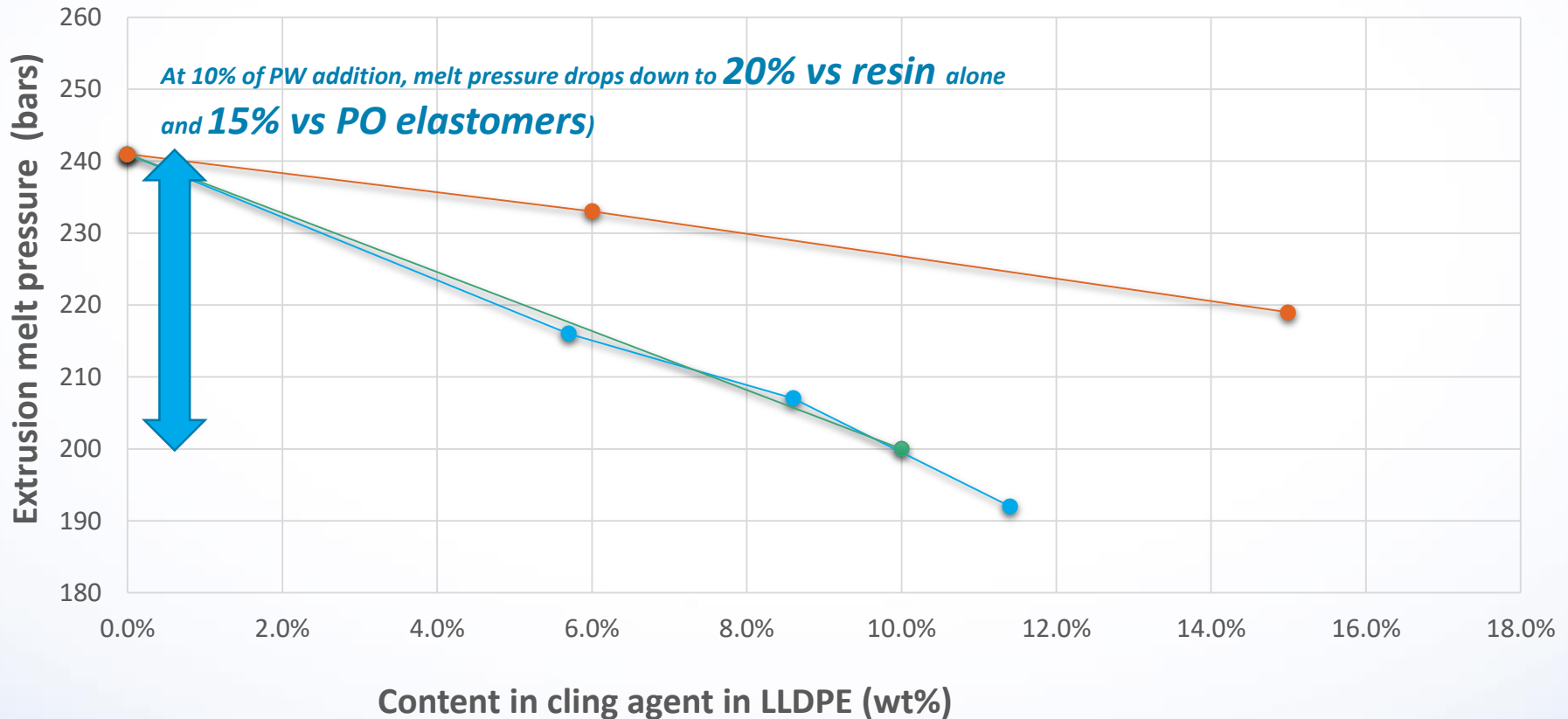
25µm film, superhexene LDDPE (MI 0.9 & d:918);
220°C ; BUR 2.5, 50 kg/h, Monolayer



PW brings processing aid effect by decreasing the melt pressure down to 20%

● PIB (PW70) ● PIB (PW60) ● Compet PP elastomer

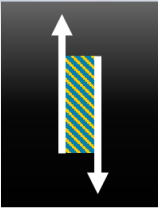
Melt Pressure evolution after addition of cling agents



25µm film, superhexene LLDPE (MI 0.9 & d:918);
220°C ; BUR 2.5, 50 kg/h, Monolayer

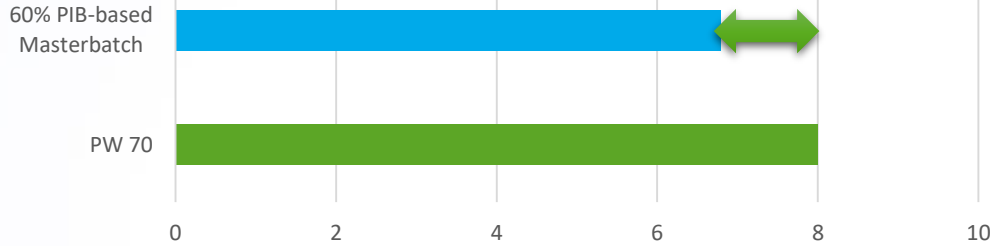


PW70 – The Best cling agent for Lap Cling effect (Food & Pallet)



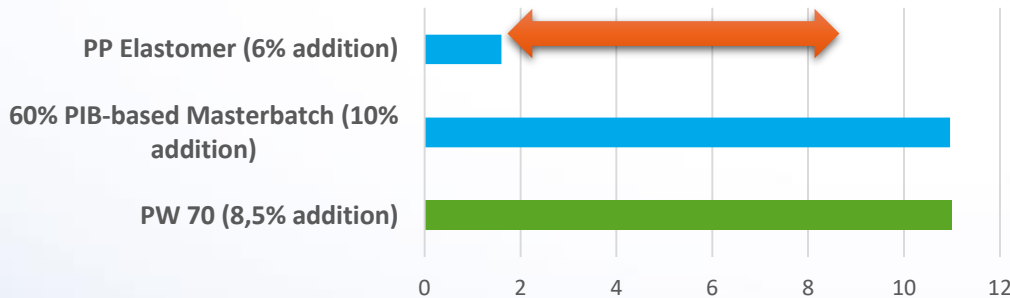
5% of PIB in LLDPE

Lap Cling (N/2.5mm) - PW70 vs 60%PIB MB



For Palletization wrapping & Food wrapping, a **LAP CLING** effect with PW70 increased by **18% vs 60%PIB MB**

Lap Cling (N/2.5mm) - PW70 vs 60%PIB MB

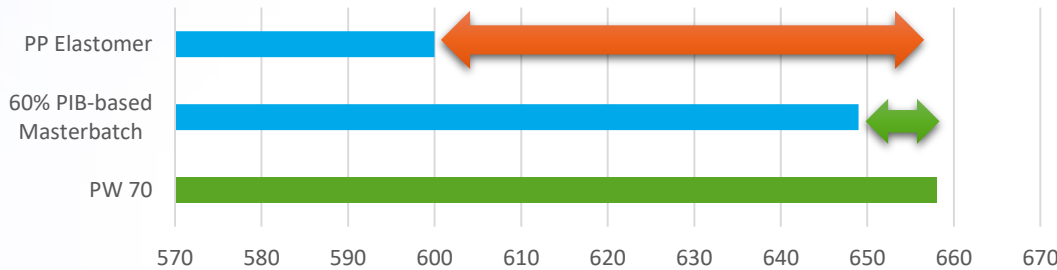


A film **7 times more efficient in lap cling** than with PP-Elastomer & providing same level than **60% PIB MB with 15% less quantity (economic gain)**



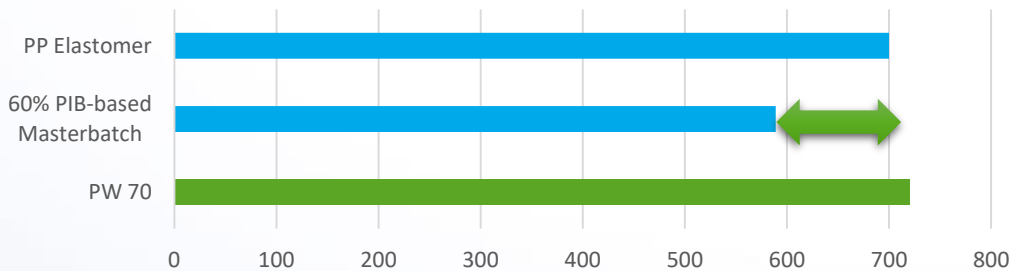
PW70 – Best cling agent to maintain & balance film mechanical properties

Tear Resistance in TD (g/25 μm) - 10% addition)



Provide film **9% more resistant to tearing than PP-E** and **1% more resistant than 60% PIB MB**

% Elongation at break in TD - 10% addition

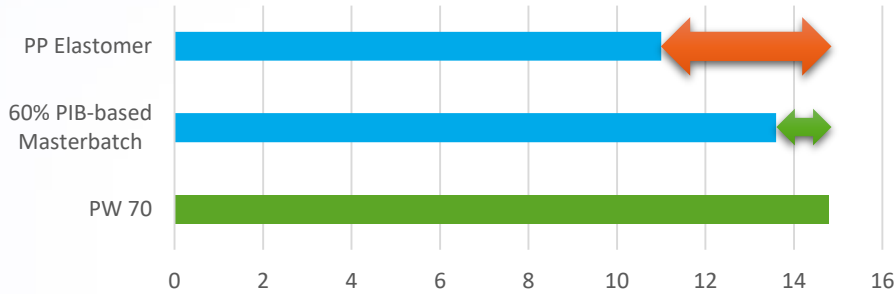


Provide film with **18% more elongation than 60% PIB MB**



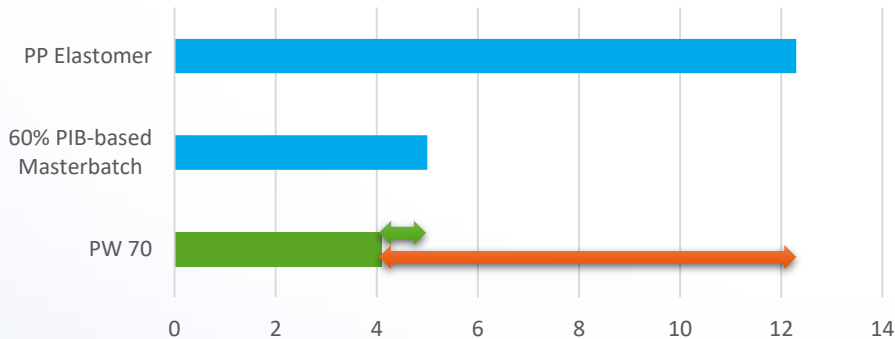
With PW70 → A clearer film and more resistant to puncture

Puncture Resistance (10% addition - Slow puncture energy (N.cm/μm))



A film resistance to puncture increased by 8% vs 60% PIB MB & up to 25% vs PP-Elastomer








Haze Level (6% Addition)



A film 22% clearer than 60% PIB MB & 3 times Clearer than with PP-Elastomer



PW as premium choice for PE Blown Stretch Films

Properties & Processing	 <i>Vs PO elastomers</i>
Lap Cling effect 	PW 7X stronger
Peel Cling effect 	PW 7X stronger
Tear Resistance 	PW maintains this property
Puncture Resistance 	PW 40% more resistant to puncture
Transparency – Haze level 	PW 3X clearer
Processing Aid effect 	PW decreases melt pressure down to 20%



*In PE Stretch Films – Technical data
for PE CAST STRETCH FILMS*



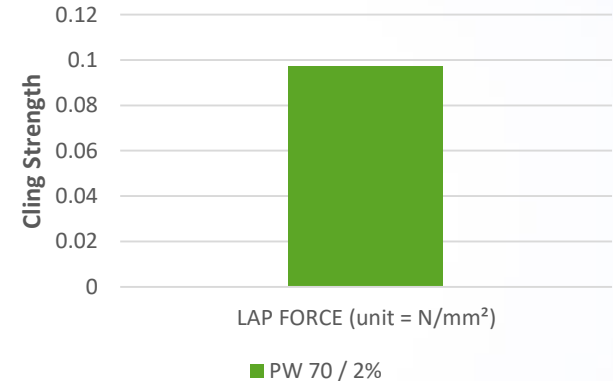
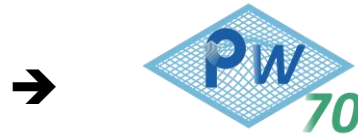
Pallet stretch film



Food stretch film

Application profiles

- 20 to 25 μm film thickness
- 3 to 7 layer coextruded structures
- Strong Lap cling strength properties
- Good transparency & Puncture resistance

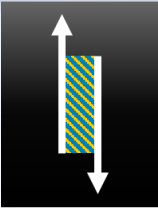


Formulation starter guide

Typical Dosing

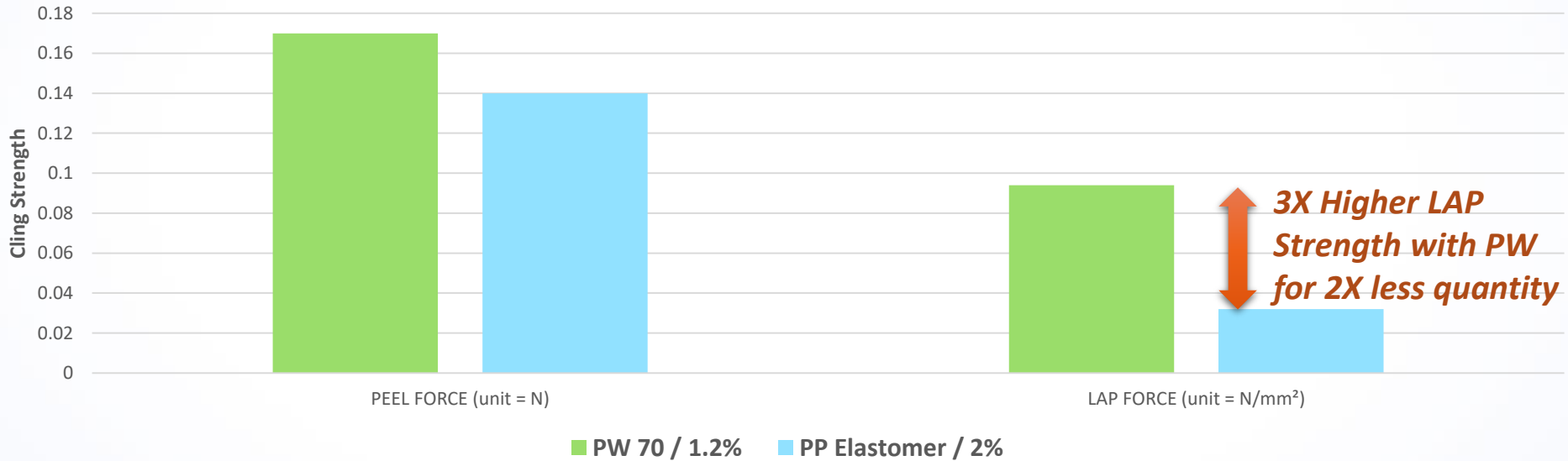
Process	Film Structure	PALLET WRAPPING		
		LLDPE + mLLDPE + LDPE	PW70	
CAST	1 layer	82% LLDPE + 12% LDPE	1.2-4%	
	2 layers	A	82% LLDPE + 12% LDPE	
		B	82% LLDPE + 12% LDPE	
	3 layers	A	100% LLDPE (0.930)	X
		B	100% LLDPE (0.918)	X
		C	82% LLDPE + 12% LDPE	1.2-4%

Process	Film Structure	FOOD WRAPPING		
		LLDPE + mLLDPE + LDPE	PW70	
CAST	1 layer	30% LLDPE + 66% LDPE + 2% AF	1-2%	
	2 layers	A	30% LLDPE + 66% LDPE + 2% AF	
		B	30% LLDPE + 66% LDPE + 2% AF	
	3 layers	A	30% LLDPE + 66% LDPE + 2% AF	1-2%
		B	50%LLDPE + 50% LDPE	X
		C	30% LLDPE + 66% LDPE + 2% AF	1-2%



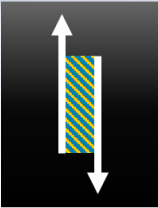
1.2% of PW70 vs 2% PP elastomer
3X Superior cling effect for 2X less dosing

PW 70 vs PP Elastomer in Cast LLDPE Film
 for Industrial & Food Stretch Films



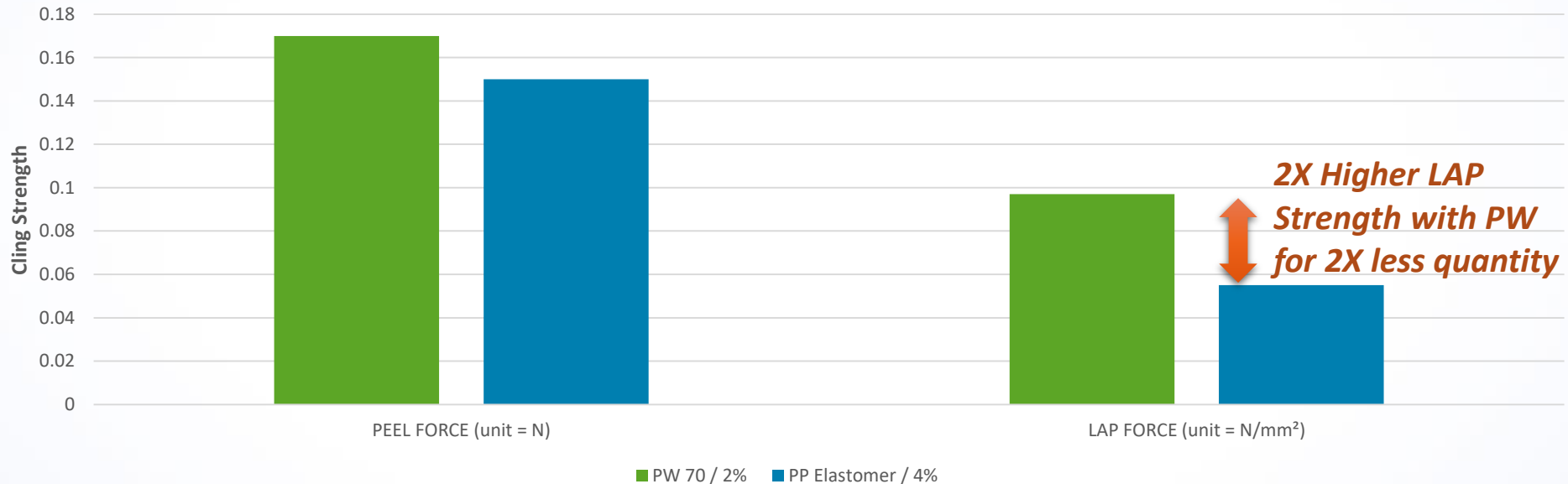
Conditions: C4-LLDPE (MI 2.6 (190°C /2.16kg) & d:918); Monolayer film ; Cast method ; film results after storage at 40°C during 2h

Disclaimer: These results have been made with a Cast film method in laboratory. The film & results were generated on a monolayer structure – then, for PW film, PIB migration happened in both surfaces of the film – reducing its cling effect in comparison to a three layer film (migration only on the cling surface – higher cling strength) / while PP elastomer-made film has reproduced real world cases (no migration – only dilution into the LLDPE .



2% of PW70 vs 4% PP elastomer 2X Superior cling effect for 2X less dosing

PW 70 vs PP Elastomer in Cast LLDPE Film
for Industrial & Food Stretch Films



Conditions: C4-LLDPE (MI 2.6 (190°C /2.16kg) & d:918); Monolayer film ; Cast method ; film results after storage at 40°C during 2h

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