

COC Enhanced Polyolefin Films for Shrink Sleeves and Labels

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TOPAS[®] Cyclic Olefin Copolymer (COC)
Your Clear Advantage.

- Sleeve Materials
 - ▶ Traditional Materials
 - ▶ Desirable Properties
 - ▶ New Developments

- Enhanced Polyolefins

- TOPAS COC for Enhanced Polyolefins



Polymers used for Shrink Sleeves

Material comparison



- **PVC** has a high density so a water flotation recycling process is impossible. It has a poor environmental image but is low cost.
- **PETG** shows a high growth rate although it is the most expensive material. Water flotation recycling process is not possible for the transparent material due to high density. It has a steep shrink curve.
- **OPS** is the dominant material in Japan. It works well for many applications, but due to temperature sensitivity, logistics can be difficult. It is less stiff than PETG and PVC. Density borderline.
- **OPP** is not considered as a shrink sleeve material due to a maximum shrinkage of 20% at 120°C in MD and low stiffness.

Developments for Shrink Sleeves and Labels Materials / Process



■ Materials

- ▶ **Recycling friendly**
 - ▶ Low density
 - ▶ Biopolymers
- ▶ **Low Density**
 - ▶ Polyolefin
 - ▶ Foamed PETG
- ▶ **Material Combinations / Multilayer films**
 - ▶ PS/PETG
 - ▶ PS/PE/PP
 - ▶ PE/PP/Cyclic Olefins

■ Process

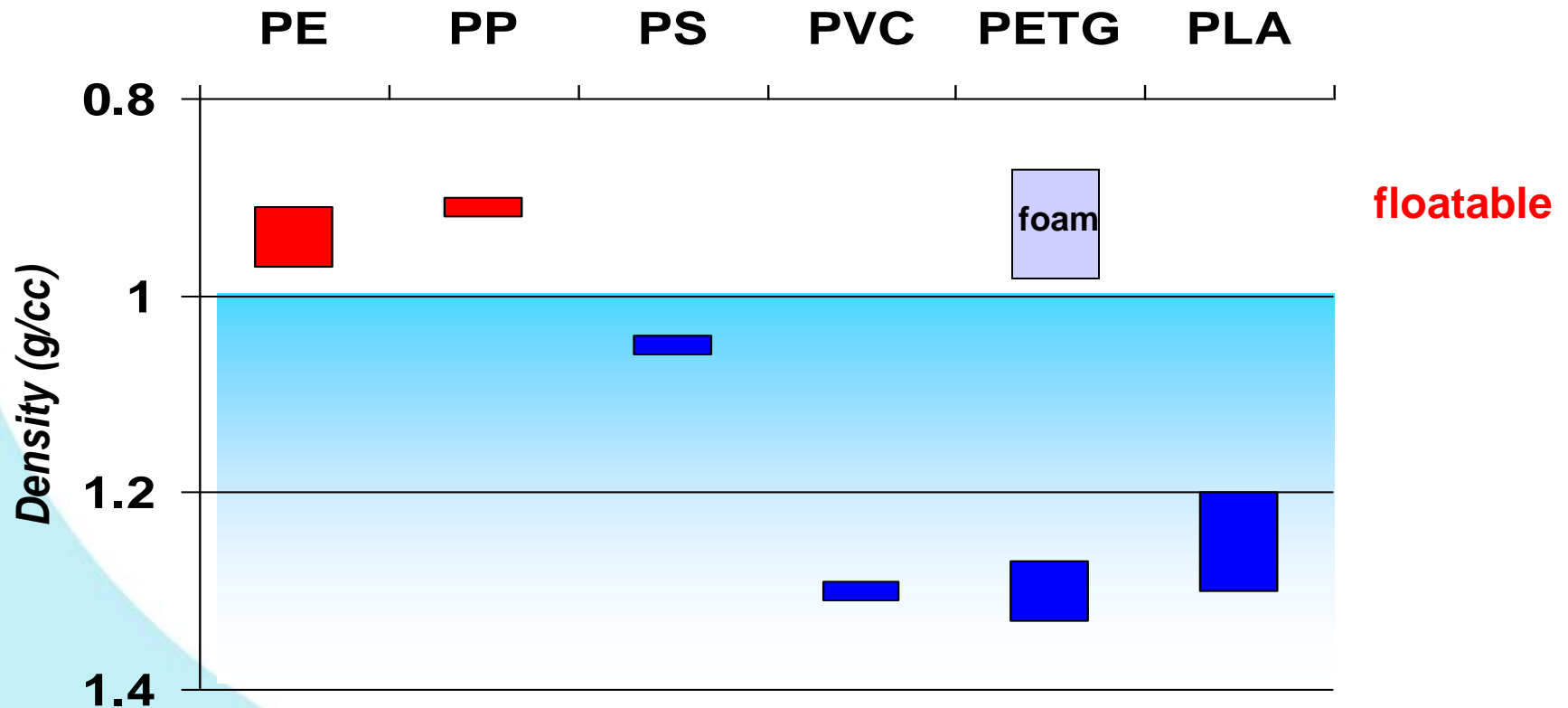
- ▶ **New roll fed shrink label technology**
 - ▶ Sealing by Laser / Ultrasonic / UV adhesive
- ▶ **High speed sleeve applicators**
 - ▶ Automatic roll change systems

- Is it about density?
 - ▶ In order to increase reclaimed PET level and quality the industry has to promote a system bottle label that:
 - ▶ Can be easily separated
 - By the consumer
 - ▶ (tear-off), or:
 - In the recycling plant
 - ▶ Increased separation efficiency
 - ▶ **DENSITY** becomes an issue for materials not separated by scanning systems



Source: AWA Shrink Sleeves Conference 2009, M. Ferraio, KP-films

Standard Polymers used for Shrink Sleeves - Density



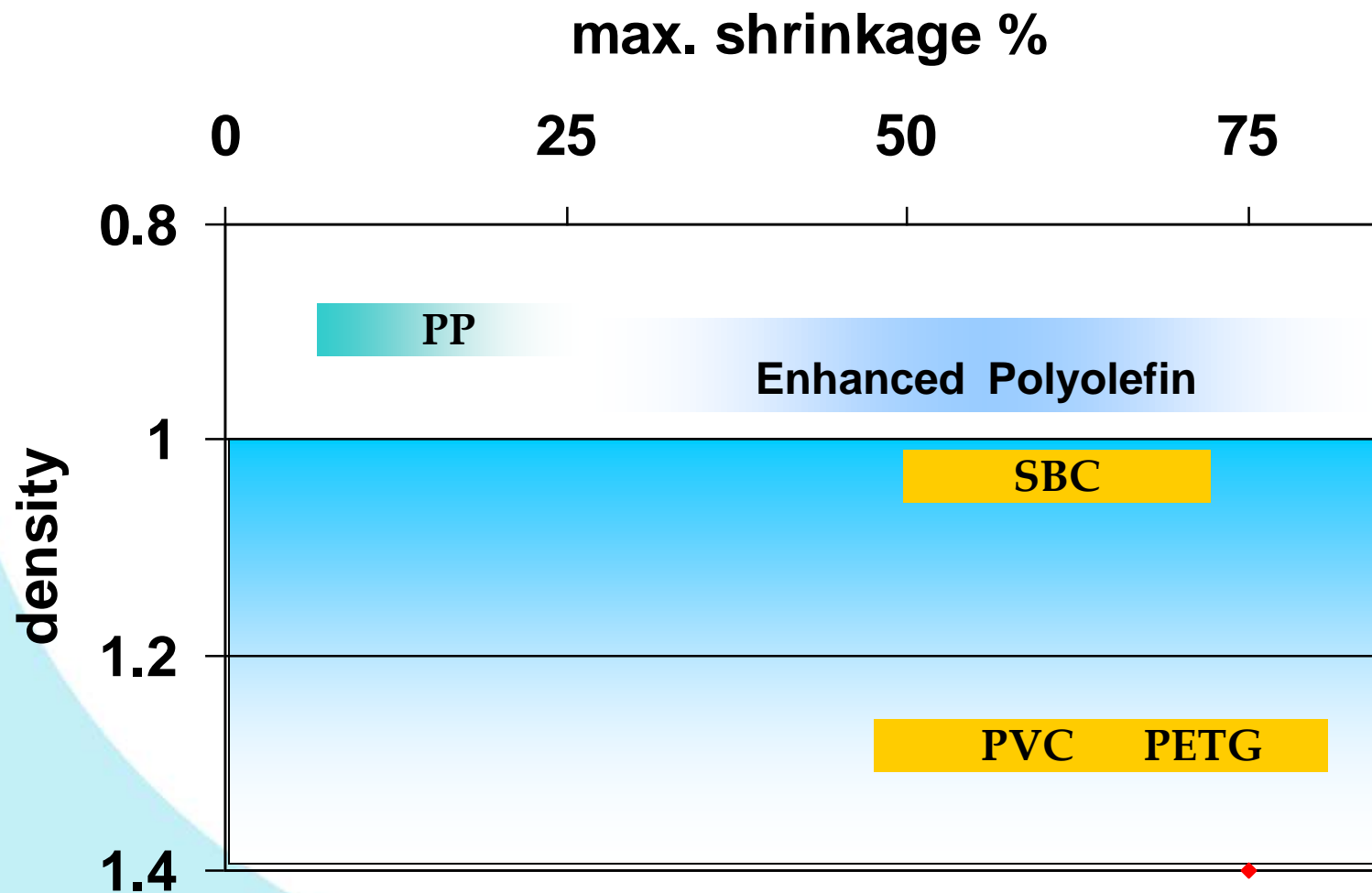
Standard sleeve materials are not floatable for water separation

Desirable Material:

Enhanced Polyolefin Shrink Sleeve and Label Substrates

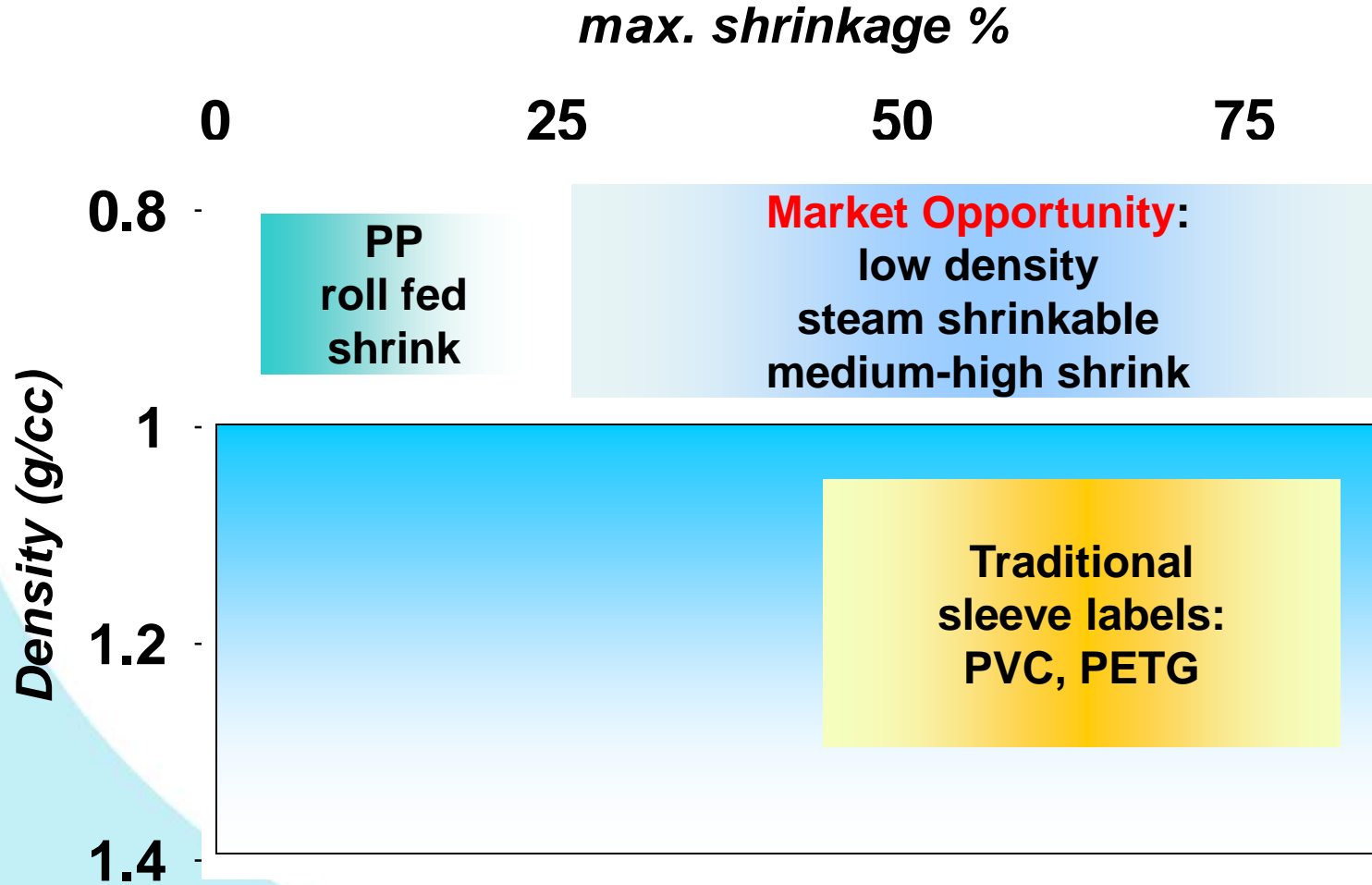
Polymer	Advantages	Disadvantages
PP	<ul style="list-style-type: none"> ▶ Desirable incumbent material ■ Low density (0.9 g/cc) ■ Low cost ■ Recycling friendly, floatable 	<ul style="list-style-type: none"> ▶ Limited functionality ■ Low shrink ■ Low stiffness ■ Not solvent sealable
Enhanced Polyolefin	<ul style="list-style-type: none"> ▶ Polyolefin solution ■ Low density (0.95 g/cc) ■ Recycling friendly, floatable ■ Solvent sealable ■ Medium-high shrink ■ Increased stiffness ■ Cost competitive with established materials 	<ul style="list-style-type: none"> ▶ More Complex ■ Multilayer film ■ Cost higher than PP
PVC PETG	<ul style="list-style-type: none"> ▶ Established standards 	<ul style="list-style-type: none"> ▶ Not recycling friendly ■ High density, 1.35 g/cc

Density and Performance of Enhanced Polyolefins



Enhanced polyolefin films can reach shrinkage above 50%

Potential for New Materials



**Medium shrink materials with low density =
Benefits for volume applications with recycling requirements**

Low density is not enough...

▶ Requirements

- Sealable, all processes
- Shrink performance
- Transparent, glossy
- Printable
- Stiff
- Low density
- Simple
- Cost efficient

Enhanced Polyolefin

Cyclic Olefins (TOPAS®) as modifier for shrink films

- Low Density (<0.97 in a coex film)
- Compatible Polyolefin, no tie layer needed
- Highly Transparent
- High Rigidity (COC modulus up to 3 GPa)
- Easily Printable, stable surface treatment
- Solvent Seam compatible
- Copolymer family with wide range of shrink properties (33 – 140°C)

- Efficient film manufacturing
- Custom shrink properties possible
- Sealable by all common processes

TOPAS[®] Cyclic Olefin Copolymer

Increased Cyclic Olefin
content

150

130

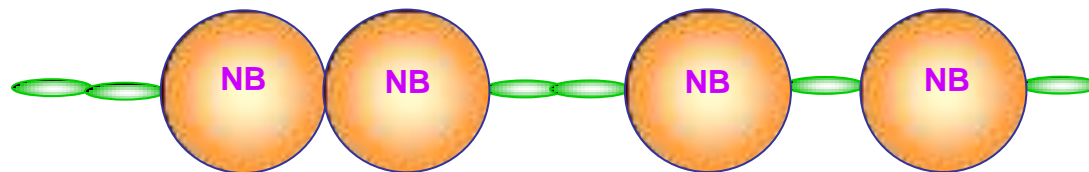
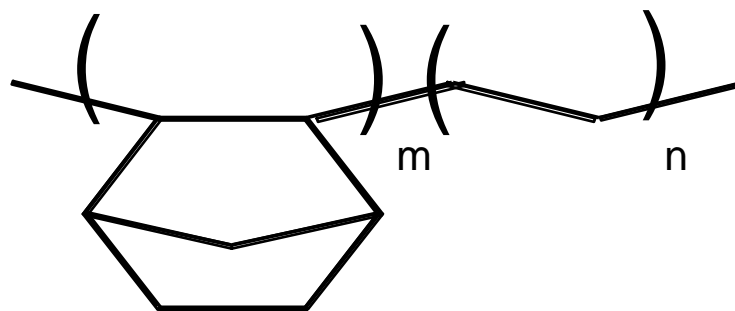
70

60

30

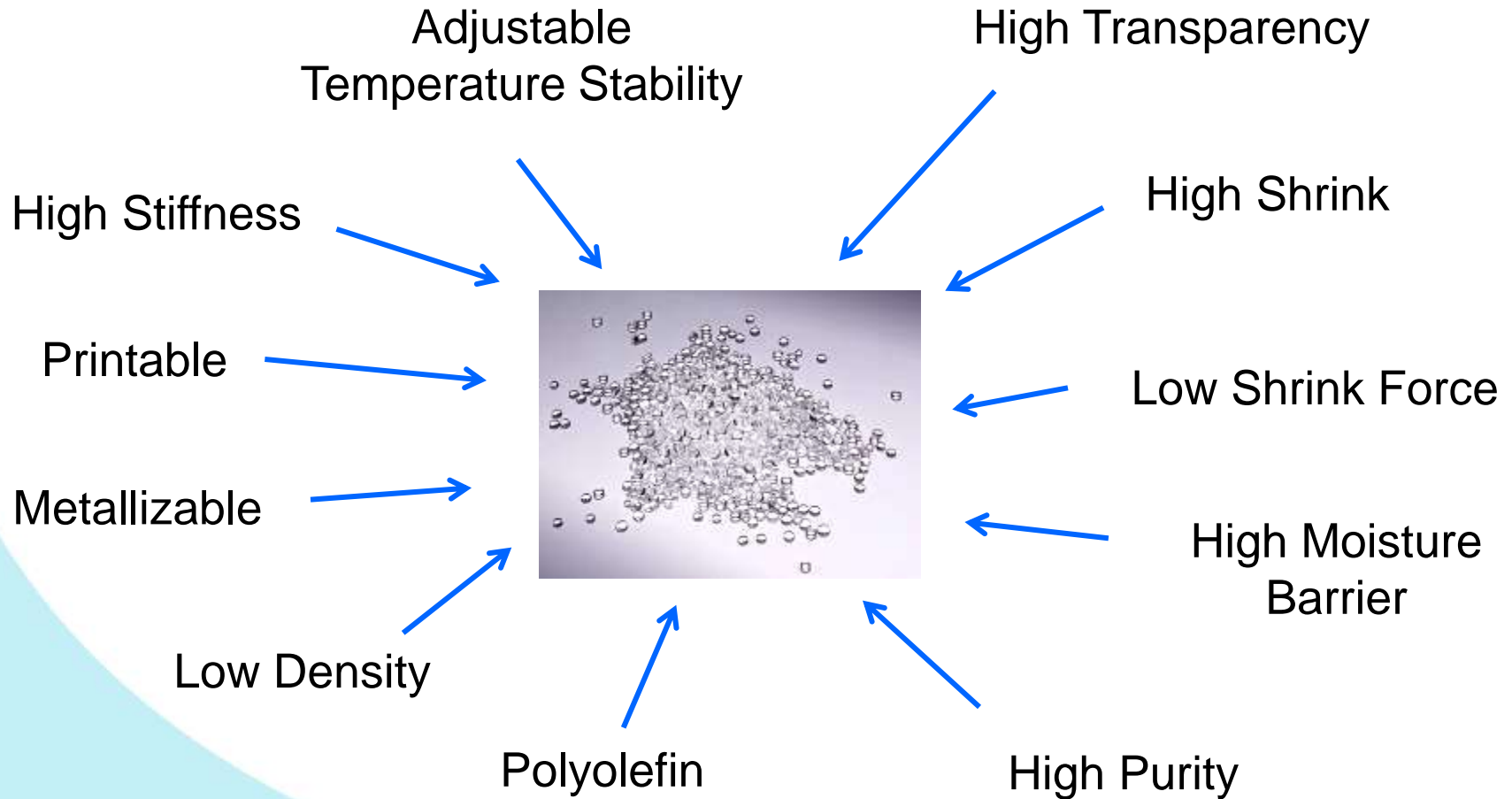
HDT °C

A random metallocene copolymer of
Cyclic Olefin and Ethylene



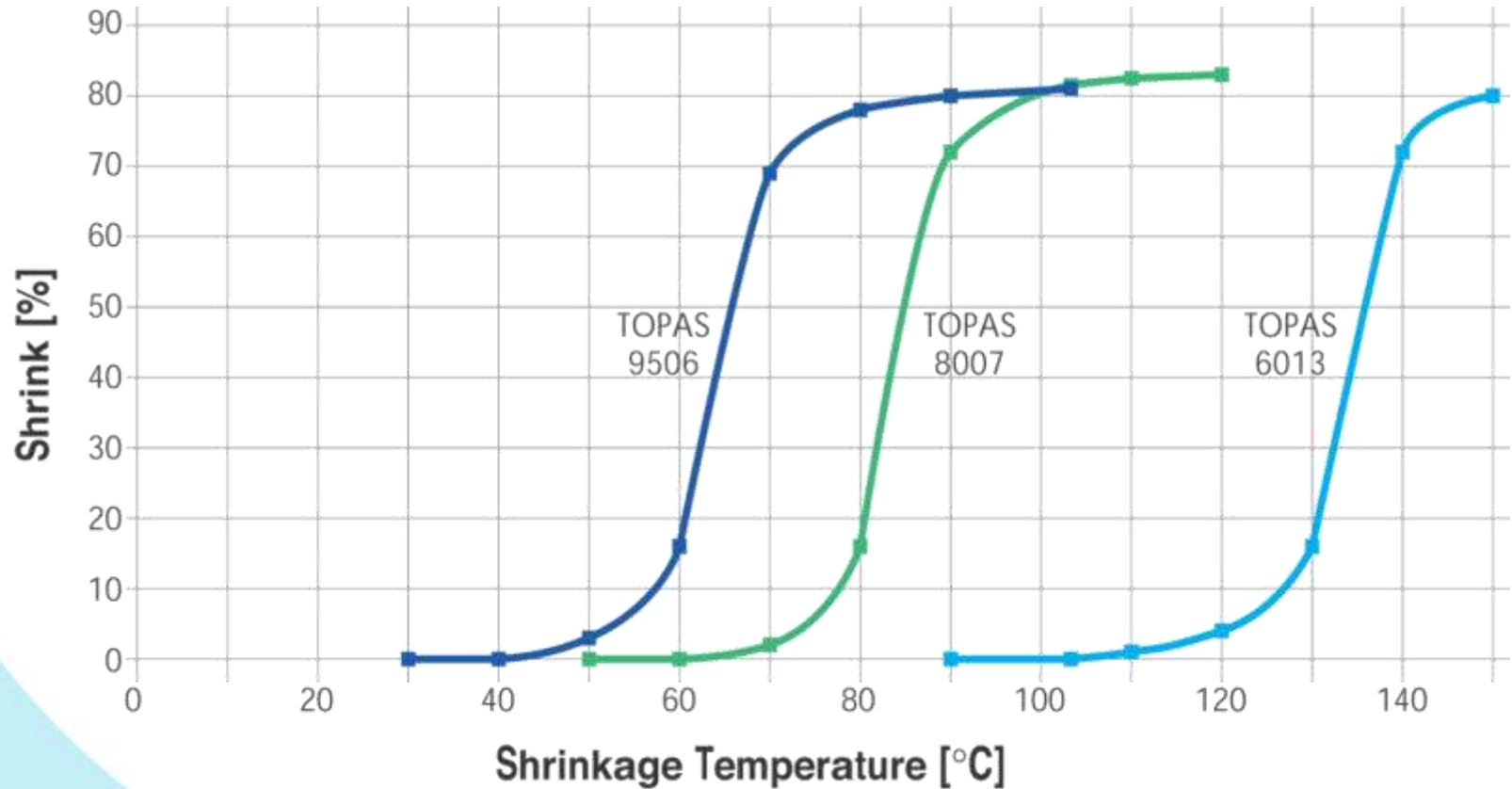
TOPAS[®] Cyclic Olefin Copolymers

A Unique Combination of Properties



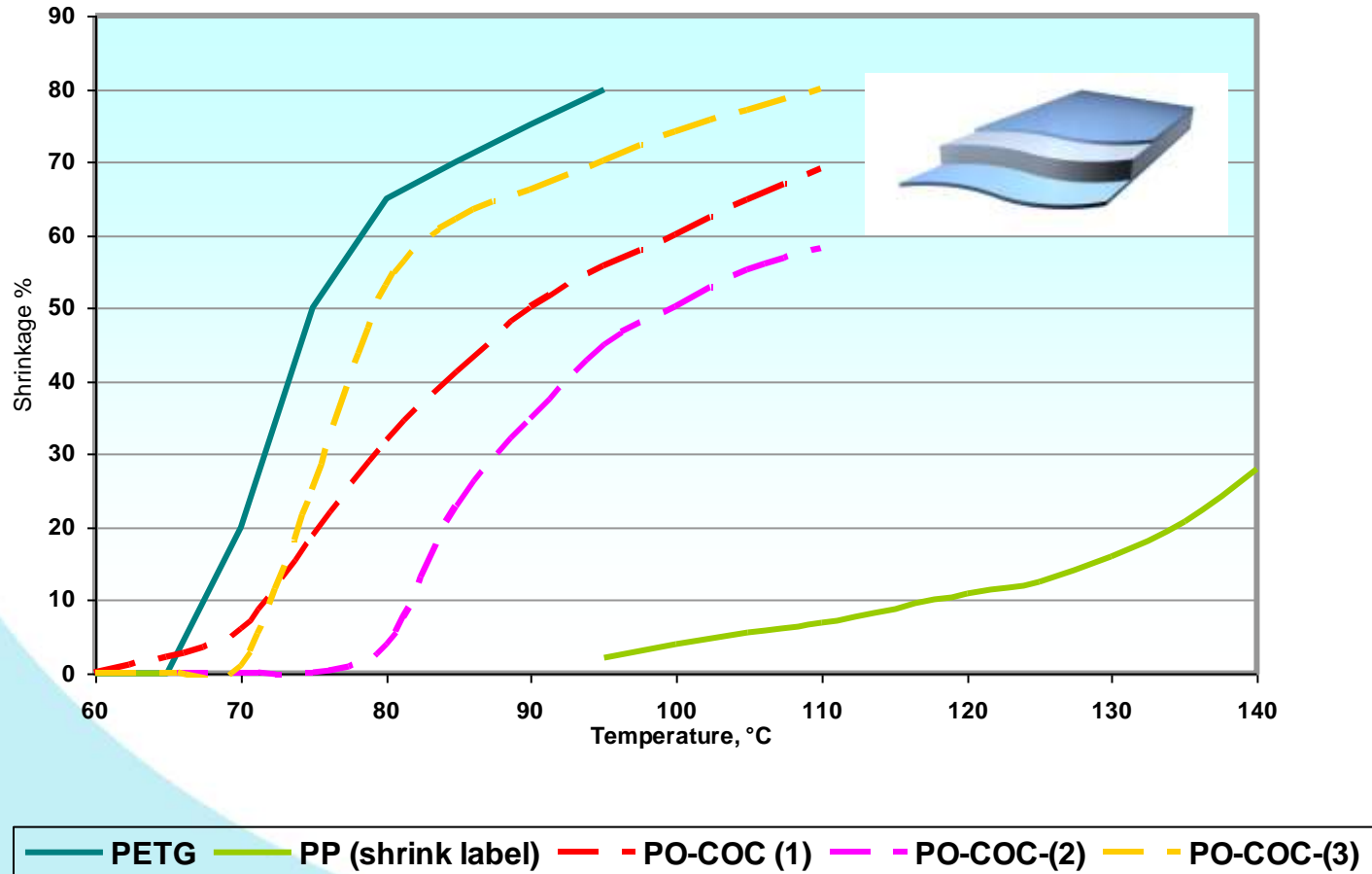
Shrinkage Curves of TOPAS[®] 9506, 8007, 6013

Grades with Tg 65 to 140°C (qualitative comparison)



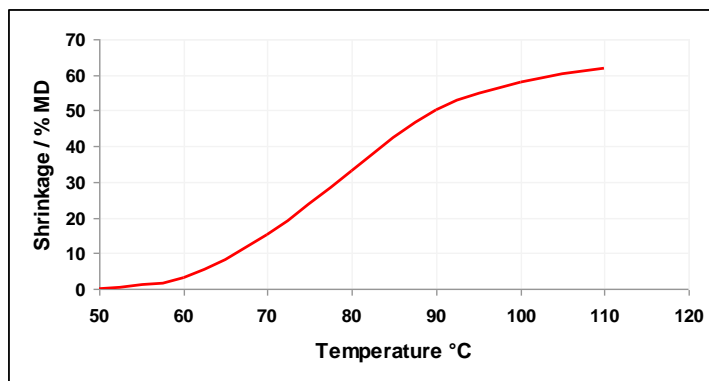
Example: Shrink Curves

TOPAS-enhanced polyolefin multilayer films



Shrink properties adjustable by formulation in a wide range between those of PP and PETG

Example: 3-Layer Polyolefin film with COC



Three layer Polyolefin film

A / B / A

A: TOPAS COC rich skin layer

B: Polyolefin rich core layer

Physical Properties

Property	Value	Unit	Test Method
Thickness	50	µm	
Solvent sealable	yes		
Density	950	kg/m ³	ISO 1183

Mechanical Properties

Tensile strength	50	MPa	ISO 527-3
Elongation, MD	50	%	ISO 527-3

Optical Properties

Gloss, 60°	130	%	ISO 2813
Haze	2	%	ISO 14782

Shrink Properties

90° C, MD	50	° C	10 sec in Oil
90° C, TD	0	° C	10 sec in Oil

Summary

Advantages of COC in Shrink Films



- COC is amorphous, polyolefinic and halogen-free
- Stretched films show high shrinkage at low shrink force
- Brilliant appearance, high gloss
- Stiff for improved sleeve handling
- Adjustable shrinkage behavior
- High yield due to low film density
- Recycling from PET by water flotation process

Last but not least

on TOPAS[®] COC and TOPAS Advanced Polymers

- ▶ TOPAS[®] COC
 - A copolymer of ethylene and cyclic olefin
 - Specialty Solutions for
 - ▶ Packaging
 - ▶ Healthcare
 - ▶ Optics
 - ▶ Electronics

- ▶ TOPAS Advanced Polymers
 - Dedicated producer of TOPAS[®] COC resin
 - As part of the Daicel/Polyplastics Group, a world-scale technical resin manufacturer

TOPAS® COC - Film & Packaging Core Segments



TOPAS® COC enhances a broad range of film and packaging applications

Thank you for your attention!

- For more information:
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