

COC Enhanced Polyolefin Films for Shrink Sleeves and Labels

AWA International Sleeve & Label Conference 2010

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TOPAS Advanced Polymers Inc.

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 not appropriate

■ 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?

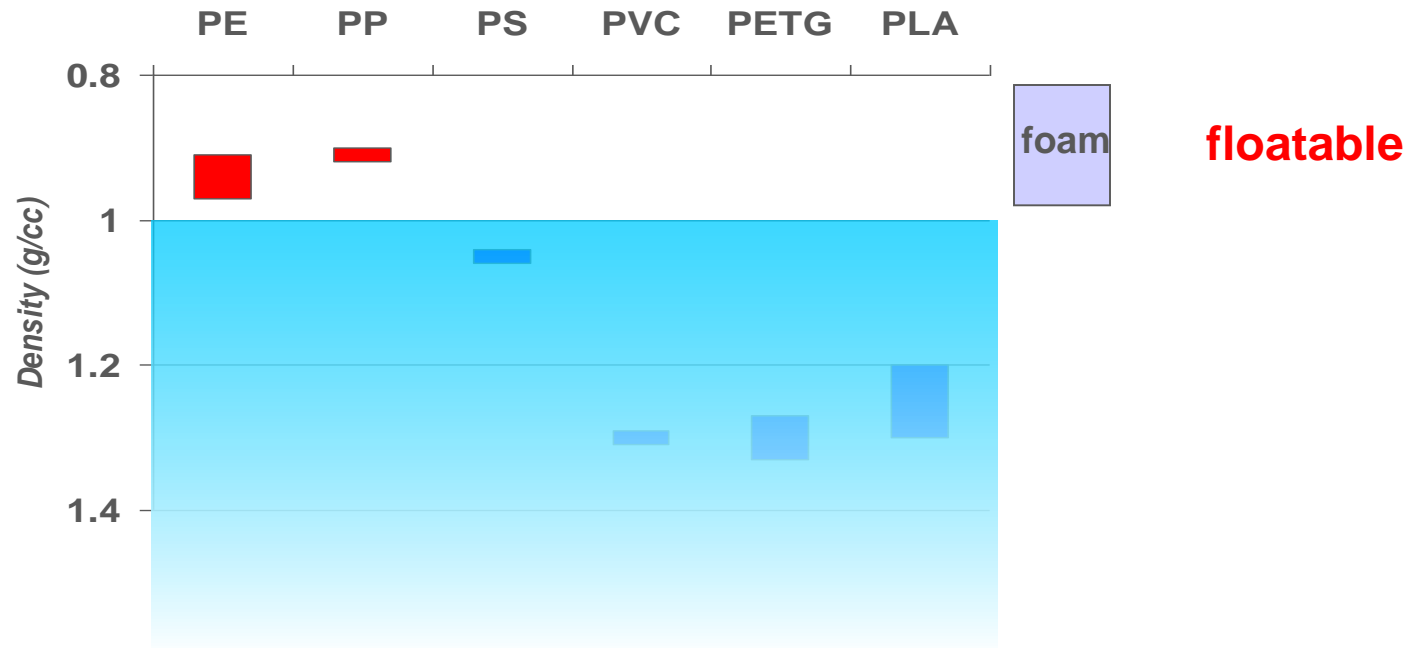
In order to increase recycled PET supply and quality the industry has to promote a system bottle label that:

- Can be easily separated by the consumer (tear-off), or:
- Will be removed 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 Shrink Sleeve Polymers - Density



Standard shrink sleeve materials are not floatable for water separation

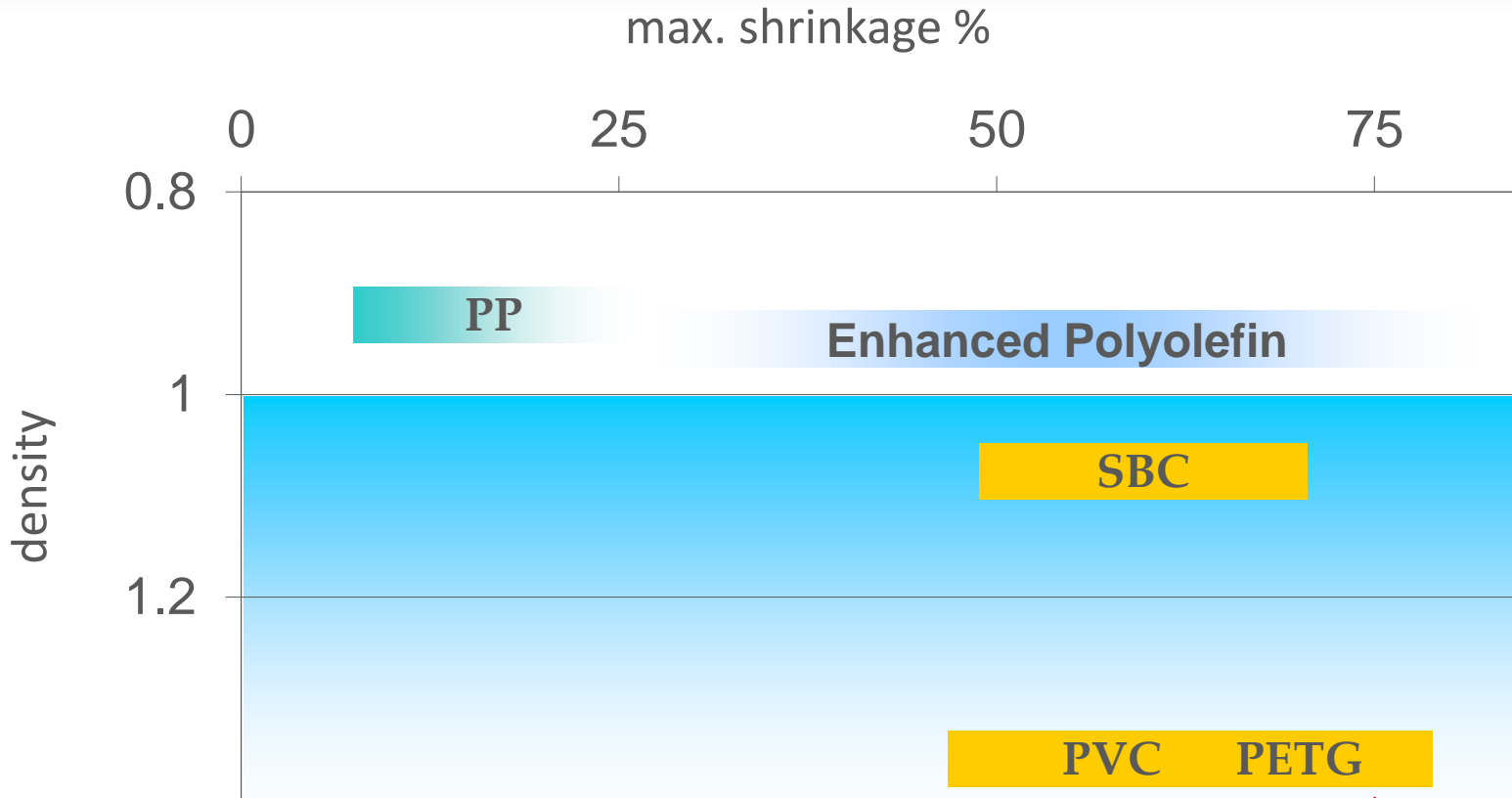
Desirable Material:

Enhanced Polyolefin Shrink Sleeve and Label Substrates



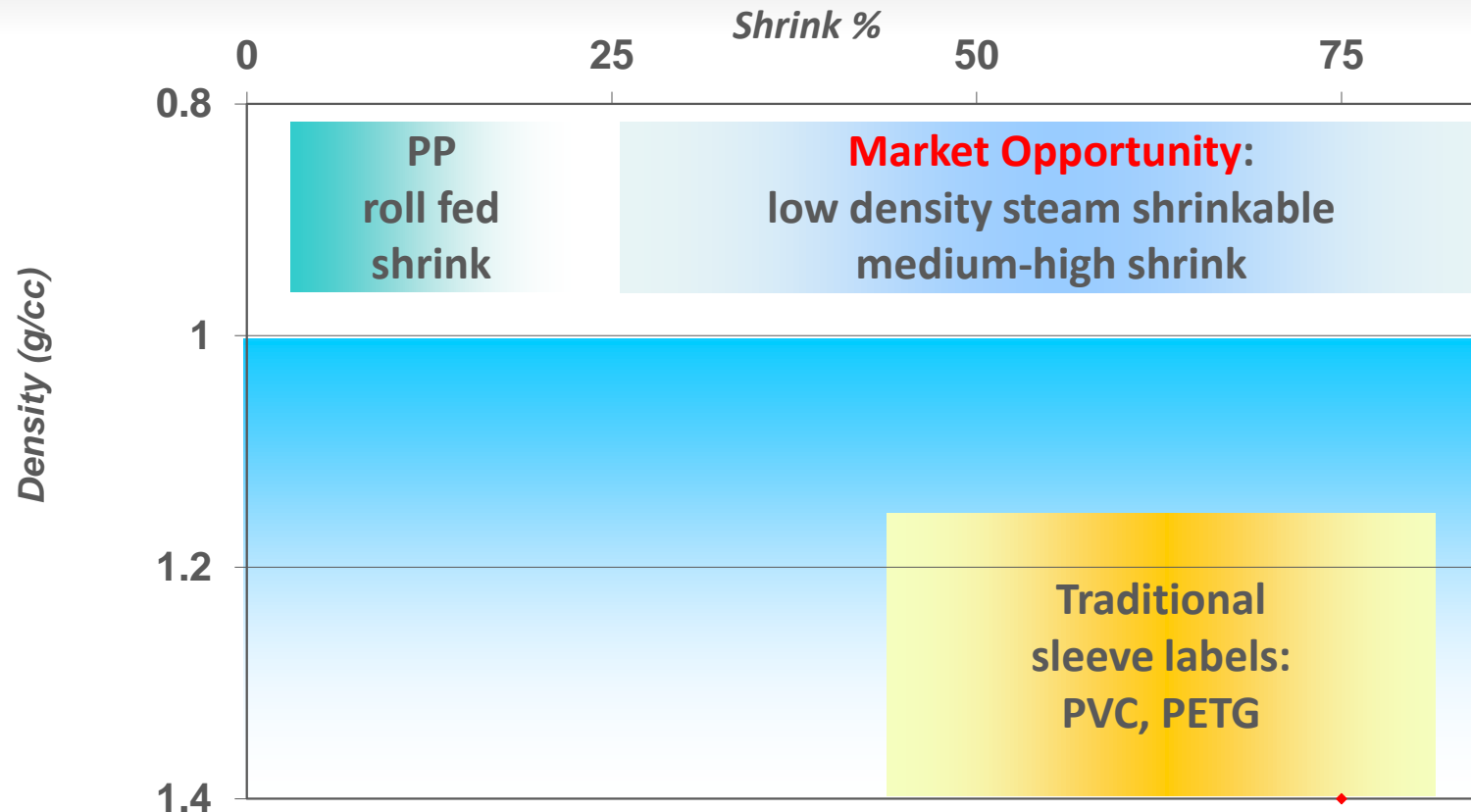
Polymer	Advantages	Disadvantages
PP	<ul style="list-style-type: none">▶ Desirable incumbent material<ul style="list-style-type: none">■ Low density (0.9 g/cc)■ Low cost■ Recycling friendly, floatable	<ul style="list-style-type: none">▶ Limited functionality<ul style="list-style-type: none">■ Low shrink■ Low stiffness■ Not solvent sealable
Enhanced Polyolefin	<ul style="list-style-type: none">▶ Polyolefin solution<ul style="list-style-type: none">■ 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<ul style="list-style-type: none">■ 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<ul style="list-style-type: none">■ High density, 1.35 g/cc

Density and Performance of Enhanced Polyolefins



Enhanced polyolefin labels float like industry standard PP non-shrink labels

Potential for New Materials



Medium to high 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
- Tough
- 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
- Tough enough to survive supply chain handling
- Custom shrink properties possible
- Sealable by all common processes

TOPAS[®] Cyclic Olefin Copolymer



Increased Cyclic Olefin
content

150

130

70

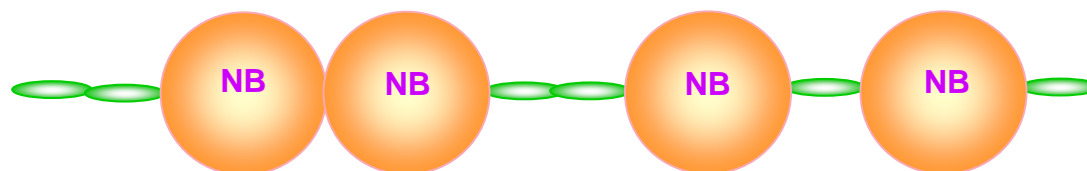
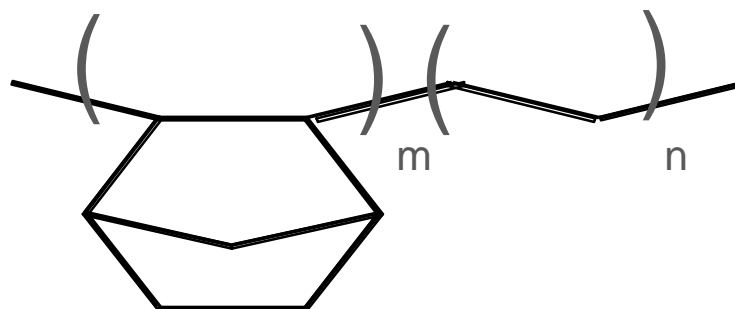
60

30

HDT °C

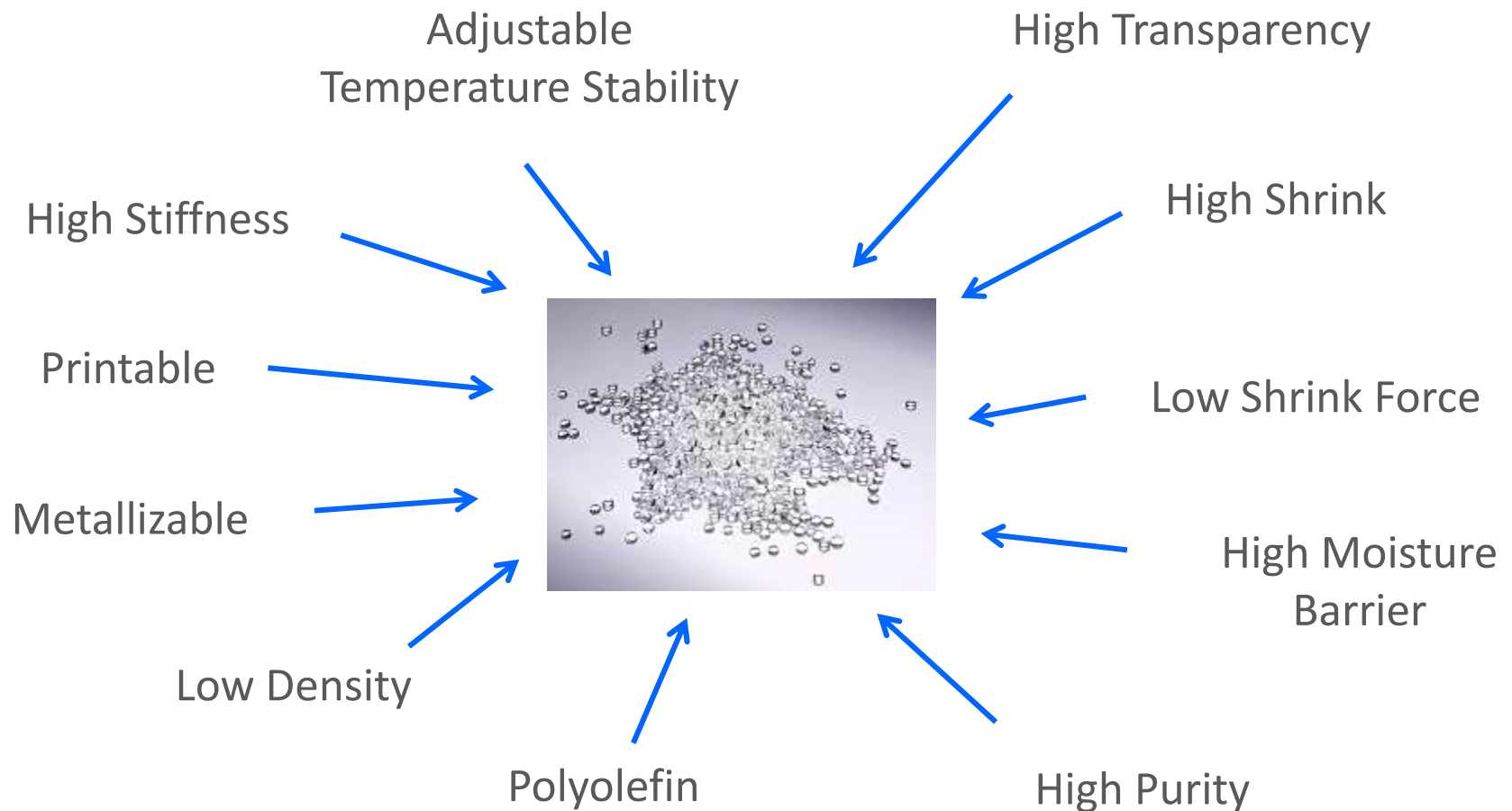


A random metallocene copolymer of
Cyclic Olefin and Ethylene

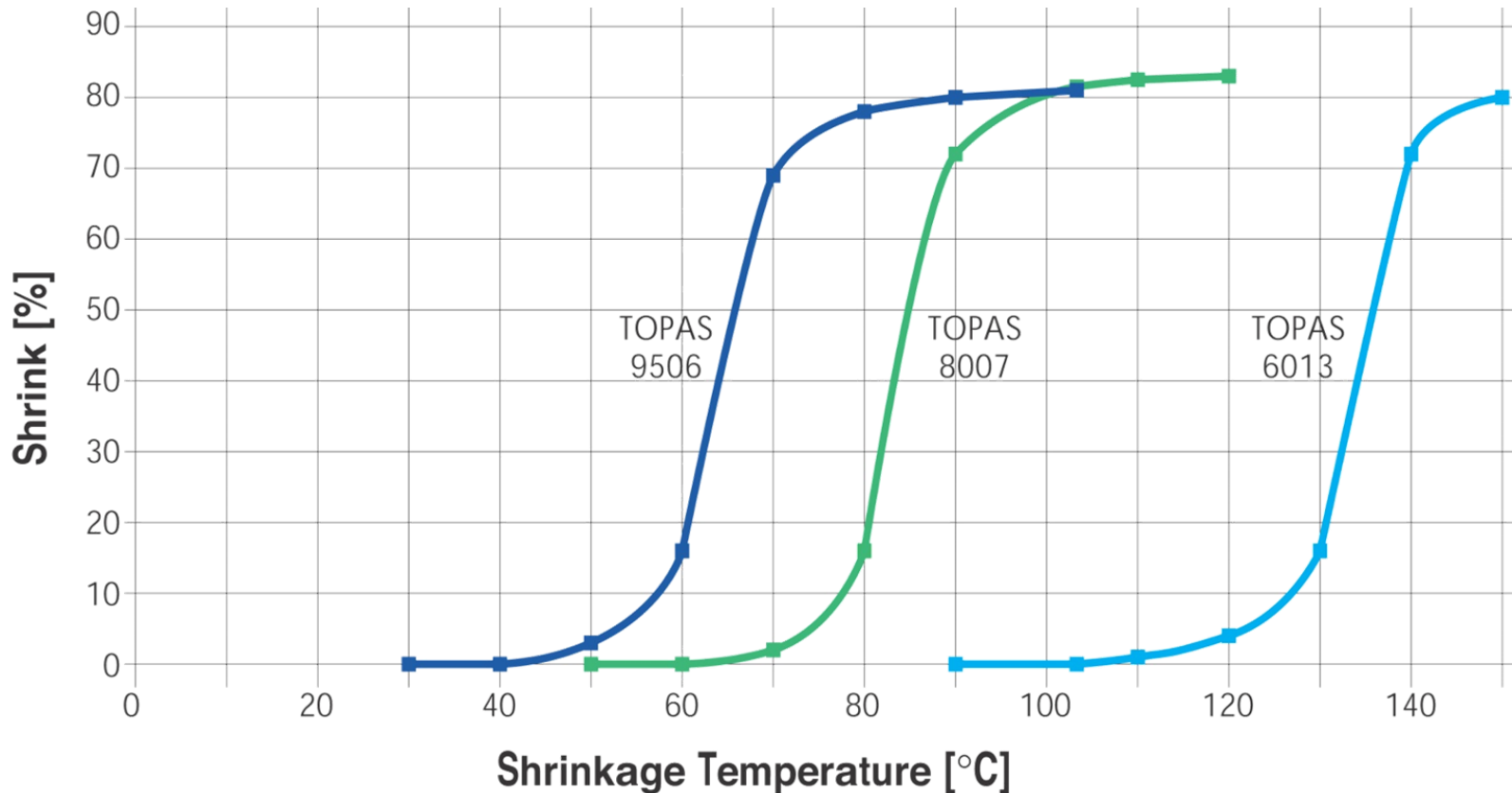


TOPAS[®] Cyclic Olefin Copolymers

A Unique Combination of Properties

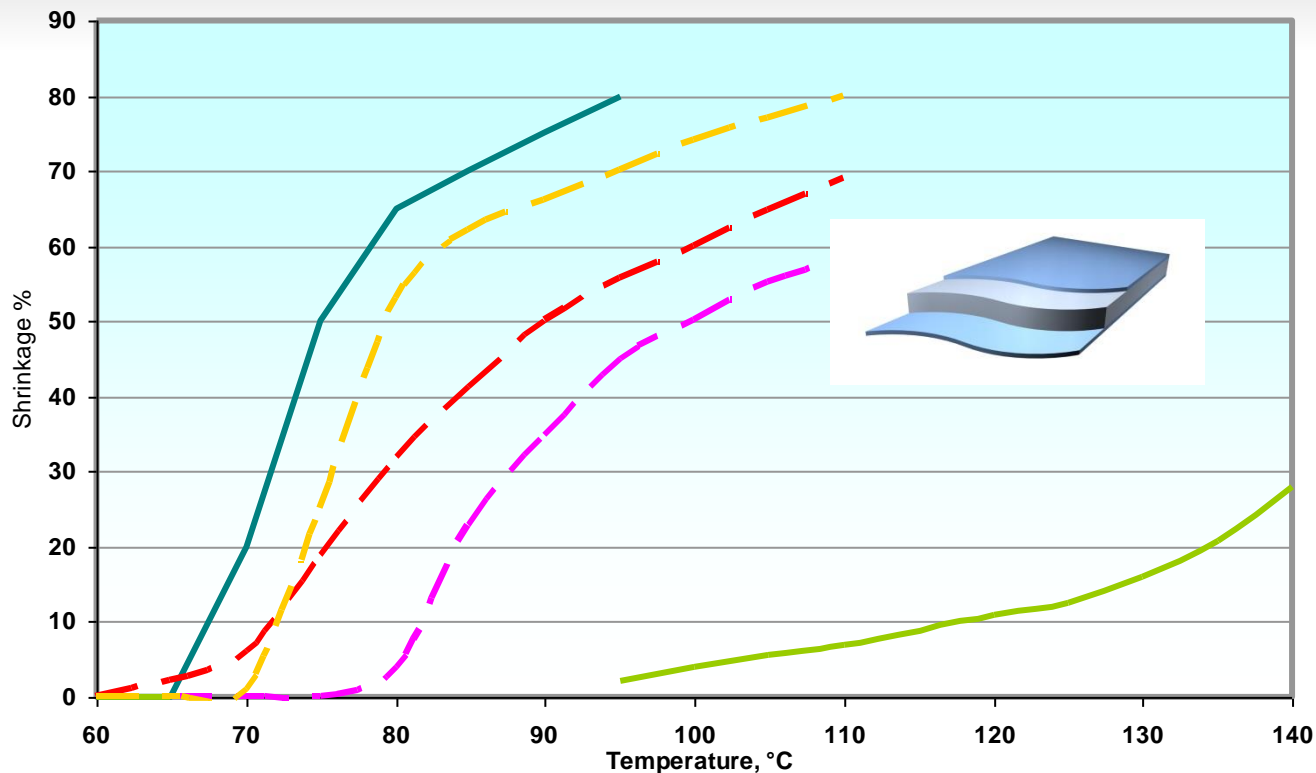


Shrinkage Curves of TOPAS[®] 9506, 8007, 6013 Grades with Tg 65 to 140°C (qualitative comparison)



Example: Shrink Curves

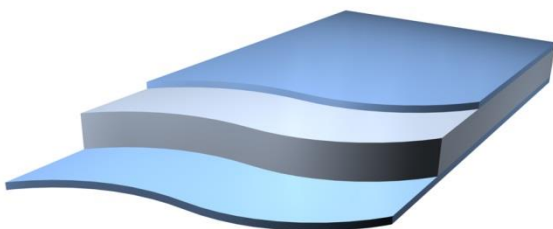
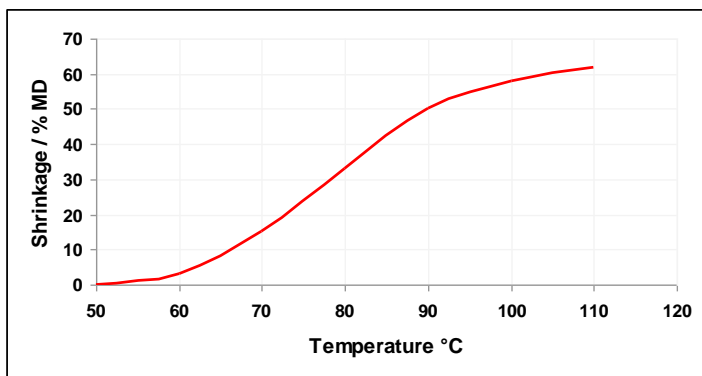
TOPAS-enhanced polyolefin multilayer films



— PETG — PP (shrink label) - - PO-COC (1) - - PO-COC (2) - - PO-COC (3)

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

Example: 3-Layer Polyolefin film with COC



Composition

Three layer Polyolefin film A / B / A

A: TOPAS COC rich skin layer; B: Polyolefin rich core layer

Physical Properties

Physical Properties	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: COC Advantages in Shrink Films



- COC is a polyolefin like PE and PP, but amorphous for high shrink
- Stretched films show high shrinkage at low shrink force
- Brilliant appearance, high gloss
- Stiff for reliable sleeve handling
- Adjustable shrinkage behavior
- High yield due to low film density
- Separates from PET by standard water flotation process
- Simplifies recycling for consumer per How2Recycle label
- Proven successful by major brand owners

Last but not least

on TOPAS[®] COC and TOPAS Advanced Polymers



■ TOPAS[®] COC

- A copolymer of ethylene and cyclic olefin
- Performance Solutions for
 - Packaging
 - Healthcare
 - Optics
 - Electronics

■ TOPAS Advanced Polymers

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

Thank you for your attention!



- For more information:

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