Thermoforming Enhancements with Cyclic Olefin Copolymers
Why Use TOPAS® COC in Thermoforming

- Improve many physical properties
- Impart new functionality, such as barrier & heat resistance; and capability, such as deep draw
- Improve material distribution & uniformity in formed article
- Improve package performance & durability
- Enable downgauging to satisfy source reduction initiatives
- Reduce cost of forming film
Formed Cavities: 8007 & Octene LLDPE

Incremental addition of TOPAS® COC clearly shows progressive improvement in appearance
TOPAS® COC: Forming Film Performance

Forming Films: Why add TOPAS® cyclic olefin copolymer?

- vs. Nylon-based films
  - improved formability, reclaiming

- vs. Ionomer films
  - improved cost, stiffness, optics

- vs. Polyolefin films
  - improved forming, stiffness

TOPAS® COC – an amorphous polyolefin bringing unique forming benefits
TOPAS® COC
Thermoforming Applications

TOPAS® Cyclic Olefin Copolymer (COC)
Your Clear Advantage.
TOPAS® COC – Forming Film Enhancement

Description:
Medical and Food Forming Films with LLDPE/COC blends or multilayered films

Value Proposition:
- Good forming properties
- Excellent dimensional stability
- Excellent stiffness
- Reclaimable for cost-effectiveness

TOPAS Grades:
8007F-600, 9506F-500
Dental Blister

Description:
Tooth whitener refill sponge container

Value Proposition:
- Peroxide resistance
- High moisture barrier
- Long shelf life
- Easy thermoforming
- Oxygen barrier layer can be added
- Light resistance available with opaque film

TOPAS Grade:
8007F-04

Converter:
Tekni-Plex
Steam Sterilizable Blister

Description:
Post-sterilizable forming film
Monolayer film (COC-rich blend)

Value Proposition:
- No shrinkage and distortion of blister film during steam sterilization (121°C/ 20min)
- High moisture barrier
- Excellent forming and die cutting behavior
- Polyolefin solution

TOPAS Grade:
6013F-04

Converter:
Advance Technology
TOPAS® COC Benefits For Thermoforming

- Improve thermoformability & enhance package integrity with less gauge variation & good dimensional stability
- Enable downgauging to reduce material cost
- Improve most physical properties, including stiffness, strength, impact resistance & optics
- COC benefits from orientation during forming more than other polyolefins
- Design recommendations:
  - LLDPE – No restrictions
  - LDPE – Minimize in LLDPE-COC blends
TOPAS® COC
Benefits of Discrete COC Layers in Thermoforming

TOPAS® Cyclic Olefin Copolymer (COC)
Your Clear Advantage.
## 6-mil Cast Film Structures

<table>
<thead>
<tr>
<th>COC</th>
<th>Monolayer</th>
<th>Multilayer</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>90% o-LLDPE (0.920 g/cc, 1.0 dg/min)</td>
<td>A: 44.5% (2.7 mil) o-LLDPE</td>
</tr>
<tr>
<td></td>
<td>10% 8007</td>
<td>B: 11% (0.6 mil) 100% 8007</td>
</tr>
<tr>
<td>15</td>
<td>85% o-LLDPE (0.920 g/cc, 1.0 dg/min)</td>
<td>A: 42.5% (2.55 mil) o-LLDPE</td>
</tr>
<tr>
<td></td>
<td>15% 8007</td>
<td>B: 15% (0.9 mil) 100% 8007</td>
</tr>
<tr>
<td>20</td>
<td>80% o-LLDPE (0.920 g/cc, 1.0 dg/min)</td>
<td>A: 40% (2.40 mil) o-LLDPE</td>
</tr>
<tr>
<td></td>
<td>20% 8007</td>
<td>B: 20% (1.2 mil) 100% 8007</td>
</tr>
</tbody>
</table>

**Equivalent COC content**

[www.topas.com](http://www.topas.com)
Radar Plot Layout & Property Description

All samples are compared to a “control” film whose properties are normalized at 100. Positive or negative property differences are denoted by “+” or “-”
10% COC Monolayer vs. 10% COC Multilayer

10% COC discrete layer construction offers “free” improvement to many properties vs. 10% monolayer blend
Best enhancements: Formed Tray Corner Puncture
15% COC Monolayer vs. 15% COC Multilayer

15% COC discrete layer construction offers “free” improvement to many properties vs. 15% monolayer blend
Best enhancements: Modulus & Formed Tray Corner Puncture
10% COC discrete layer construction offers cost savings improvement to many properties vs. 10% & 15% monolayer blend

Best enhancements: Modulus, and Formed Cavity Corner Puncture
20% COC discrete layer construction offers “free” improvement to many properties vs. 20% monolayer blend
Best enhancements: Modulus, Tensile & Formed Tray Corner Puncture
15% COC discrete layer construction offers cost savings improvement to most properties vs. 15% & 20% monolayer blend
Best enhancements: Modulus, and Formed Cavity Corner Puncture
Forming Benefits With Discrete COC Layers

- Flat film enhancements include stiffness, strength and optical properties
- Thermoformed tray enhancements include puncture resistance, corner thickness & reduced gauge variation
- Films with discrete layers of COC can reduce material cost without sacrificing performance
- Films with discrete layers of COC have better barrier properties

Maximize cost-benefit ratio and film performance
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